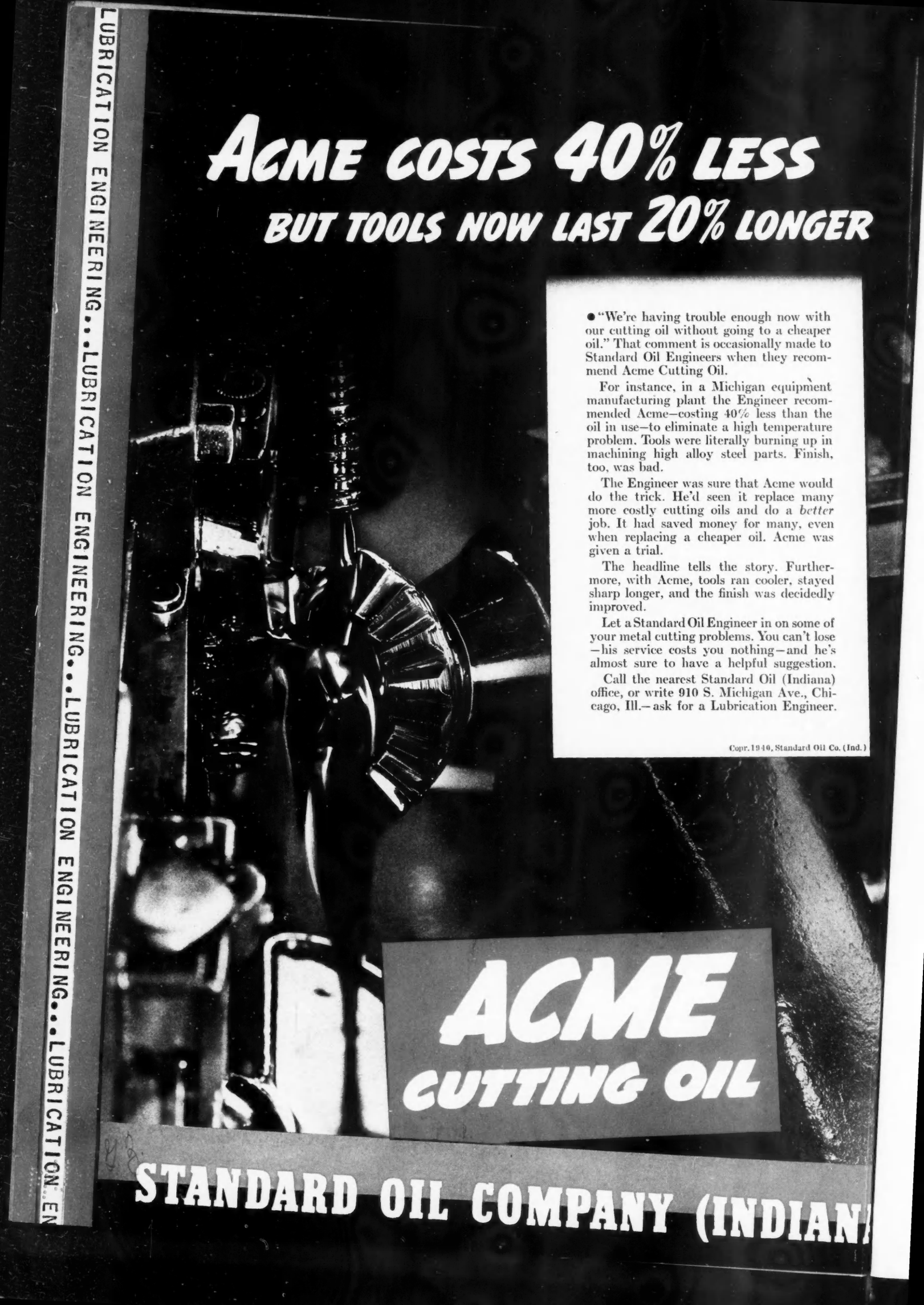
AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

JULY 1, 1940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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
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Volume 83 Number 1

CONTENTS

Automotive Division
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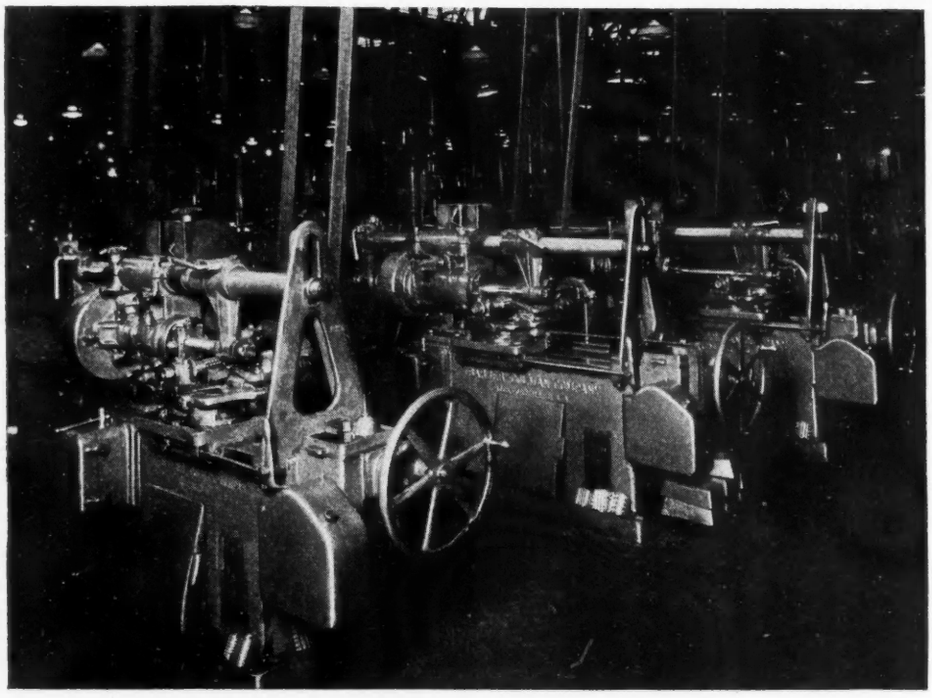
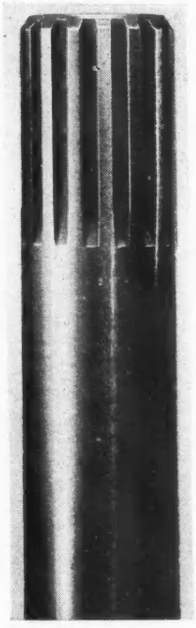
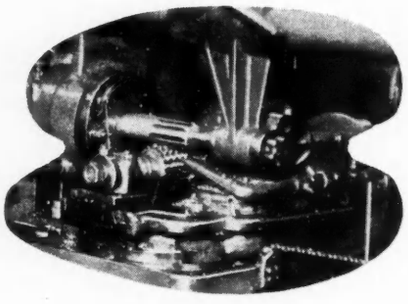
50% INCREASE IN HOB LIFE



BARBER-COLMAN HOBBING MACHINES in automobile plant. The job is cutting splines. Cutter life increased 50% by changing to *Texaco Sultex Cutting Oil.*



A 50% INCREASE IN HOB LIFE ...without any sacrifice of finish or output...has resulted from using *Texaco Sultex Cutting Oil.*



THIS BATTERY of Barber-Colman Hobbing Machines cutting splines on automobile drive shafts has increased hob life 50%.

This saving was not accomplished at the expense of output . . . both feeds and speeds remain exactly as before. Finish is even better.

This improvement was due solely to the use of *TEXACO SULTEX CUTTING OIL B.*

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TEXACO SULTEX
CUTTING AND SOLUBLE OILS

IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 83 July 1, 1940 Number 1

Volumetric Efficiency Although the term "volumetric efficiency" has been used in the literature of internal-combustion engines for several decades, no authentic definition has ever been adopted, and that it can be used in different senses was brought out quite plainly in the discussion of a paper by Professor Taylor of M.I.T., at the S.A.E. summer meeting. All agree, of course, that it is the numerical ratio between two magnitudes of the same dimensional character, and also that one of these magnitudes is the mass of air which actually enters the cylinder per cycle under the operating conditions considered. The other magnitude always has been considered the mass of air which would enter the cylinder under ideal conditions, which latter, however, have never been specified. During the suction stroke the cylinder acts as a pump, and the maximum amount of air which could possibly enter it during that stroke would be that corresponding to the displacement volume at the temperature and pressure of the surrounding atmosphere. In an actual engine the maximum amount of air which could be taken in would be slightly reduced by the fact that about 2 per cent of the space is occupied by the vapor of the gasoline mixed with it, and the amount retained would be slightly reduced further by the fact that the inlet valve always closes only some 45 crankshaft degrees past bottom center, with the result that at low speeds some of the air drawn in during the suction stroke would be forced out again during the first part of the compression stroke. It would seem, however, that these two influences on the maximum amount of air in each charge could properly be neglected in setting the base for "volumetric efficiency" determinations.

Another question that arises is whether the term should be so defined that it applies to operation under both part-throttle and full-throttle. It seems to us that "volumetric efficiency" has real significance only when applied to full-throttle conditions, for when the engine is throttled the amount of charge the cylinder receives per cycle is primarily a matter of control and not of the efficiency or relative capacity of the inlet tract.

Eliminating the above factors, the discussion at the summer meeting showed that there are still at least three different conceptions of the base for volumetric-efficiency determinations. Professor Taylor in his paper suggested the cylinder-displacement volume at inlet-manifold density. In the discussion the cylinder-displacement volume at the density of the surrounding atmosphere was suggested, and the writer has been using cylinder-displacement volume at standard atmospheric density.

It would seem preferable to so define the term volumetric efficiency that it is a function of the design of the powerplant and of its speed only, and independent of atmospheric conditions (or the density of the air at the entrance to the inlet tract). This would necessitate making cylinder-displacement volume at the density of the surrounding atmosphere the base.

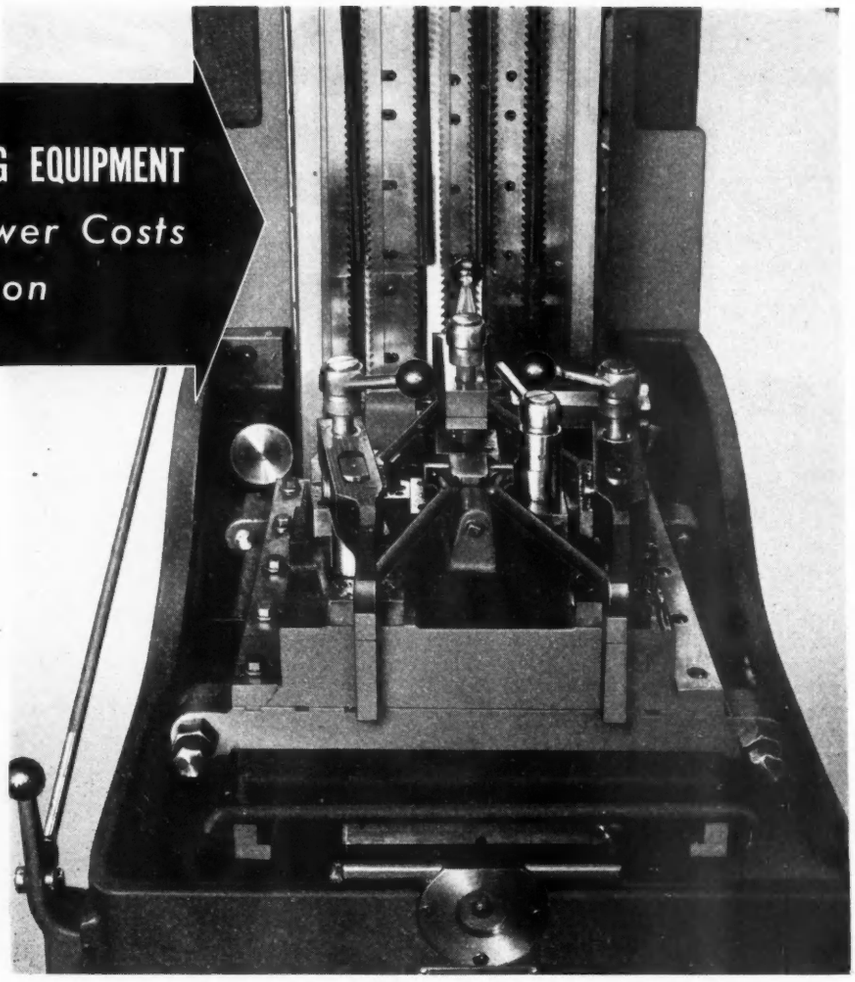
Some of those who discussed the subject at the meeting went to considerable pains to so phrase the definitions that they would cover supercharging conditions. This, however, seems unnecessary and even objectionable, firstly because it leads to expressions of more than 100 per cent efficiency, which always carry an air of unreality, and secondly because the effect of the supercharger on the charge supplied to the cylinder can be properly expressed by the term "supercharge ratio," which may be defined as the ratio of the density of the charge at the carburetor inlet to the density of the surrounding atmosphere (assuming, of course, that there is no compressor in the line beyond the carburetor).

As was pointed out at the meeting, it is highly desirable that the term "volumetric efficiency" should be authentically defined and it is to be hoped that the competent division of the S.A.E. Standards Committee will give the subject its attention.—P. M. H.

Since 1913 all issues of AUTOMOTIVE INDUSTRIES have been indexed in the *Industrial Arts Index*, which can be consulted in any public library.

THIS "WISHBONE" BROACHING EQUIPMENT

Turns a Wish for Lower Costs Into Realization



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AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 83, No. 1
July 1, 1940

Let's Get Together

The country is far from unified on how far or how fast we shall prepare for a national emergency. A year ago England was in much the same state of national opinion

By HERBERT HOSKING

THIS paragraph begins at an hour when the Republican National Convention opens its twenty-second official life span in Philadelphia. It begins simultaneously with an exercise of the democratic process which may consume from two days to two weeks in public exercise of the right of criticism, of nominating speeches which will gild some lilies and attempt to gild some pseudo-lilies. A great deal of what transpires at the convention (and this is said in no partisan sense) will come under the head of piddling while the world burns. The process will be repeated in a few weeks at the Democratic National Convention. The main streams of oratory, during the whole period will be accompanied by the Congressional world-freshets which rise quickly in the Spring of a political campaign, and by thousands of individual utterances of the sort which are only listened to during a heat of a political season.

There is grave danger that, under such conditions, the most important fact in the world to all Americans will be obscured. That fact is, that as the leading defender of democratic institutions in the western hemisphere, we are unarmed for defense. Its corollary is that we may soon be the sole defenders of our way of life in the whole world. We may have to defend a continent and two oceans. And we may be called upon for more than verbal defense within a time which grows terribly shorter with each passing day.

The Congress has shown itself willing to expedite into law a defense program which nearly all sides agree is one which will not unduly tax the resources or the organizing ability of the United States. Expediting the program itself has been placed in the hands of a civilian National Defense Advisory Commission. Within a week after the appointment of the commission, some governmental action toward mobilization of industry, which had been accused of being politically motivated, was placed in the hands of the commission to continue. Under the pressure of criticism of the way things have been done, which is an essential right under a democratic form of government, the recent tendency has been to organize the defense program smoothly into the fastest channels.

Public attitude on the question of the speed necessary for arriving at an adequate defense organization varies roughly between the attitude of the man, who

because of the speed and nature of military events in Europe, dives under his desk (at least mentally) every time there is a loud crash in the street or office; and the attitude of the man who wants to know what all the shouting is about, and what does it matter to us who wins the war in Europe. Both positions are sincerely taken, in the case of scores of people you can recall in your own list of acquaintances.

The point is, that the country is far from unified on the question of how far and how fast we shall proceed in getting ready for a national emergency of a military character.

A year ago, England was in about the same state of national opinion. It was evident that the policy of international appeasement sponsored by Mr. Chamberlain was falling into ruins under the pressure of events. It was evident, too, that England's defense program was not proceeding as rapidly as the possible requirements of insular and outland protection made desirable. Those in England who were trying sincerely to put into effect an industrial mobilization scheme found their path blocked by apathy, jealousy, political expediency, and all the other poisonous plants which flourish along with the good things in democracy.

The measured words of a great liberal organ, *The Economist*, of London, have found many echoes since they were written last August. Under the title "The Parliamentary Watchdog," the editorial begins:

"A quarter of a century ago this week end, (from Aug. 5, 1939) the armies began to march, and the lamps of liberalism went out all over the world. Today, twenty-five years later, the armies are again massed in readiness for the word of command and the lamps of decency and moderation—those few that were ever re-lighted — are again flickering low. It is idle now to speculate on the parts played by fate and by mismanagement in bringing us back to the same sorry pass in less than a generation. The war of 1914-18 was manifestly not a war to end wars. It can hardly, in its end results, be be called a war to make the world safe for democracy. Indeed, it was not, seen in retrospect, a war *for* anything; it was a rearguard action such as civilization has always had to fight, and may have to fight again, to ward off the doctrines of tyranny and militarism which threaten the caravan of human progress towards betterment."

Those are words which might have been written by Abraham Lincoln, in the same mood in which he wrote the Gettysburg Address. Later in the same editorial *The Economist* climbs down from its peak of disillusionment to survey the confusion at its feet.

"There is a tendency today (the editorial continues) even among convinced democrats, to speak as if democratic institutions were necessarily slow, unimaginative and ineffective. This belief, in its current form, dates back to the speech in which Lord Baldwin tried to shuffle off the blame for his own procrastinations on to the electorate by saying there was a necessary time lag of two years before a democracy could be made to realize the necessity for painful action."

Continuing, the editorial defends the imagination of the electorate against Baldwin's courage, and concludes that the preceding two years produced no evidence to show that democracy is less efficient than a less representative system.

The year that has followed, since the writing of that editorial, seems to us to have supported *The Economist's* rhetoric as being stronger than its judgment of democracy in England.

The two-year time lag noted by Mr. Baldwin, while it may not be a *necessary* part of a democracy's preparation for emergency is an ever present menace. It is our confident belief that the resources of American democratic government will find a way to shorten the period between the emergence of an emergency and the recognition of it by the population at large, and by the industrial leaders of the nation.

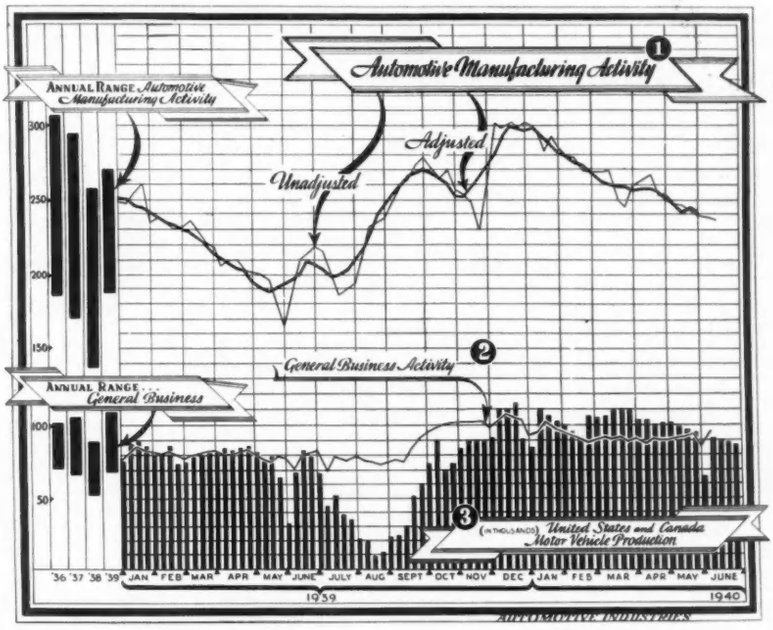
We are confident also, that the industrial and military preparation on a vast scale which must follow the recognition of an emergency will yield as a problem before the "spontaneous cooperation of a free people" which Woodrow Wilson designated as the highest efficiency.

The Brass-Hat Rack

"I wish you wouldn't drive down here to the office to meet me every night!"

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive general business charted

1940 Production Passes 2,500,000

PRODUCTION in the motor car and truck industry maintained a seasonally high level during June, with little variation from week to week as the factories kept pace with the new car orders. Production for the month was estimated[3] at 356,000 vehicles, a substantial gain from June, 1939, when 324,235 units were turned out. However the drop from May's output of 412,492 motor cars and trucks, by A.M.A. estimate, was more pronounced because there was one less working day in June. Production for the first six months of 1940 now has passed the 2,500,000 mark.

Output for the week ending June 22 was approximately 89,500 units, while the last week of the month was expected to total several thousand units less. General Motors plants turned out 40,500 vehicles for the week of June 22, while Chrysler produced 18,300 and Ford's output was 17,400. Studebaker maintained its steady manufacturing pace to top the independents, followed by Packard, Nash, Hudson, Willys, Graham, and Hupmobile.

Although some manufacturers plan to shut down on 1940 model production after the July 4 holiday, the output for July is expected to remain reasonably high. Automobile company executives have emphasized the fact that the rearmament program will not affect motor car production. Ford already is preparing to manufacture airplanes but this is not interfering with the normal automotive output.

Retail new car deliveries for May were estimated at 385,736 units by the A.M.A., a drop of 6 per cent below April sales but 19.4 per cent above May, 1939. The percentage of gain over 1939 was the smallest for any month this year, the average gain for the first four months of 1940 being 29.9 per cent. This may be a reflection of the European war situation, which has injected a note of caution into consumer buying.

Total domestic retail sales for the first five months of 1940 are estimated at 1,765,122 units, of which 266,145 were commercial vehicles.

Sales reports of four GM divisions for the first 10 days of June showed gains ranging from 16 to 49 per cent over the same period of 1939. The corporation's domestic retail sales for the first five months of 1940 have run 25 per cent ahead of the corresponding period in 1939.

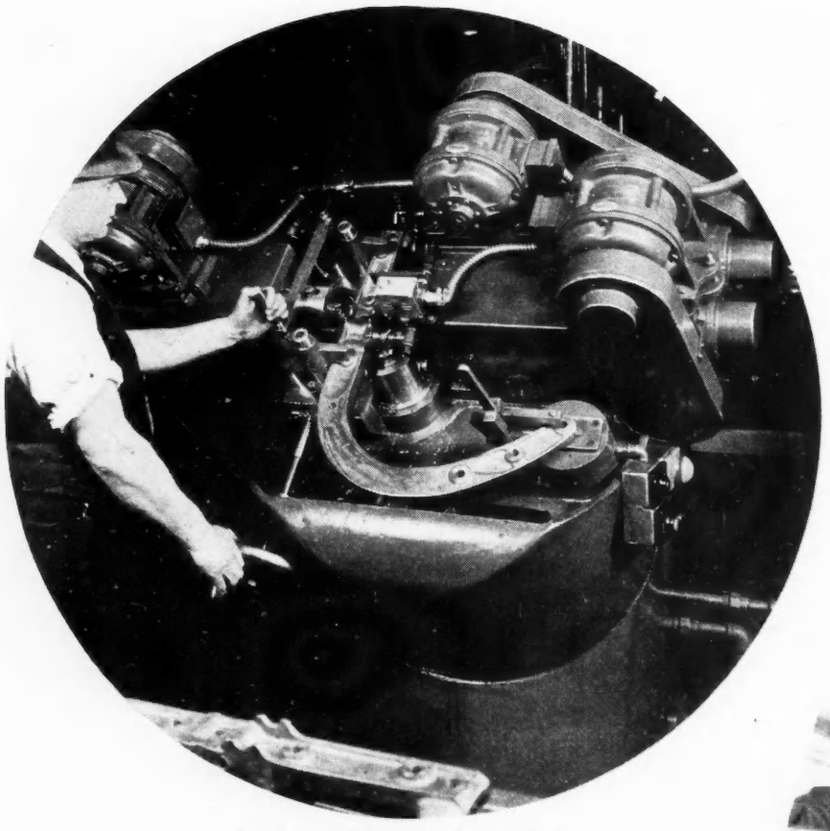
Chevrolet turned out its 900,000th 1940 model in mid-June and is on the way toward the 1,000,000 mark. Mercury and Cadillac both exceeded their total 1939 model production during June. Chrysler division sales for the first two weeks of June were the greatest for that period in the company's history since the days of the four-cylinder Chrysler.

Packard sales for the first five months were 42 per cent ahead of 1939.

AUTOMOTIVE MANUFACTURING ACTIVITY continued easing off through the weeks ended June 8 and 15 as indicated by the unadjusted index figures of 238 and 236 plotted on the accompanying chart. Likewise the adjusted curve reproduced herewith moved down through the weeks ended May 25 and June 1 to 244 and 241, respectively.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

Following



Special milling machine tooled for the plow beam casting.

Ford tractor assembly, on the line, begins here in the building up of the rear axle assembly, following the swaging of the brake drum on the axle hub and pressing-in of the hub bearing. Note the hi-angle wrench, used extensively on the tractor line to reach otherwise inaccessible fastenings.

By JOSEPH GESCHELIN

"INVITATION TO THE LAND" was Henry Ford's theme in launching the new Ford tractor, based on the Ferguson system, in June, 1939. Priced at $585 for the basic unit, at Dearborn (taxes extra), it marks a new concept of how to farm with power. The tractor is built in the great River Rouge plant, sold and distributed by the Ferguson-Sherman Manufacturing Corp., Dearborn, Mich.

New from stem to stern, the tractor was so designed for production as to take advantage of Ford's pioneering efforts in the field of metallurgy, particularly in the utilization of unique steel casting procedures. How well this goal was achieved may be appreciated from the fact that a total of 1155 lb. of castings are employed in a unit weighing but 2100 lb. Table reproduced on page 6 in this article gives the essential chem-

This is the Fiftieth in the series of monthly production features

Ford Tractors Down the Line

ical specifications of each of the steel castings, together with the heat treatment.

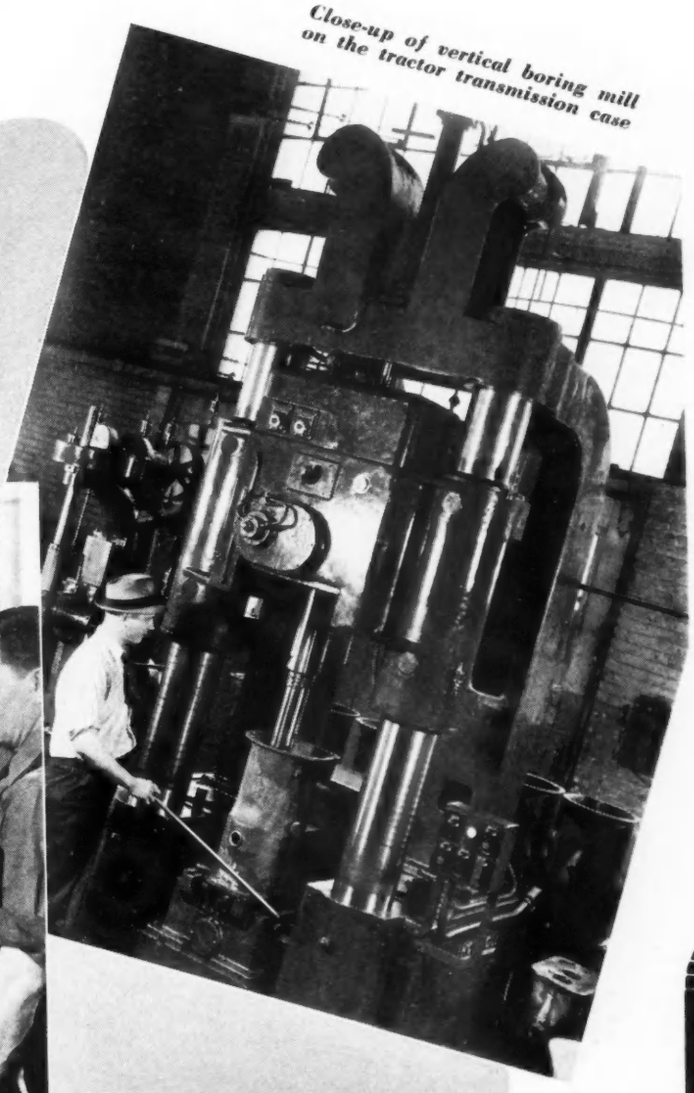
The engine employs the characteristic features of current Ford design in the form of an in-line four-cylinder, L-head construction. Pistons, intake valves, springs and guides are interchangeable with those of the Mercury, while the cast camshafts and crankshafts are of similar basic design. Outstanding element of the engine is the replaceable dry cylinder liners of heat-treated, drawn sheet steel construction. Cast tungsten steel inserts are used for both intake and exhaust valve seats.

In keeping with the tenets of Ford manufacturing economy, the various parts are made in suitable machine shops distributed throughout the main plant.

As an example, the cylinder blocks are machined on a special line located in the foundry machine shop department, adjacent to the machine lines for the V-8's. Crankshafts, camshafts, pistons, connecting rods, and other engine parts are fabricated in the regular departments producing similar parts.

However, the special elements required for the main body of the tractor are so different from standard

Close-up of vertical boring mill on the tractor transmission case



Tractor hydraulic units are checked for acceptance in this testing machine developed by Ford. The pump action is tested for pressure against operating speed; maintenance of pressure; relief valve action

PRODUCTION

Cast Steel Analysis Chart

Type	Parts	Carbon	Copper	Silicon	Manganese	Molybdenum	Chromium	Phosphorus	Sulphur	Miscellaneous	Heat Treatment and Hardness
No. 1	Steering Wheel Hub Radius Rod Yoke, Etc.	0.25–0.35	1.50–2.00	0.60–0.80	0.40–0.60			0.05 Max.	0.08 Max.		Normalize to Brinell Hardness of 137-197. Cyanide if specified as per print.
No. 2	Truck Ring Gears and Parts to be Carburized	0.18–0.25	0.50–1.50	0.20–0.40	0.40–0.60	0.25–0.35	0.10 Max.	0.05 Max.	0.05 Max.	Ni. 1.65–2.00	Normalize-Carburize and direct quench or reheat and oil quench and draw to Rockwell "C" 58-62.
No. 3	Centrifugal Castings Trans. Countershaft and Differential Ring Gear	0.30–0.38	0.50–1.50	0.20–0.40	0.55–0.75	0.10–0.20	0.80–1.00	0.05 Max.	0.05 Max.		Normalize to Brinell of 170-196. Harden gears as per part print.
No. 3B	Tractor and Truck Transmission Gears	0.38–0.45	0.50–1.50	0.20–0.40	0.55–0.75	0.10–0.20	0.80–1.00	0.05 Max.	0.05 Max.		Normalize to Brinell of 170-196. Harden gears as per part print.
No. 4	Tractor Radius Rods Tractor Front Axle Rear Axle Flange, Plow Beams, Etc.	0.35–0.45	0.50–1.50	0.20–0.40	0.70–0.90			0.05 Max.	0.05 Max.		Anneal to Brinell of 163-207 or water quench and draw to specified hardness.
No. 6	Balls and Races	0.90–1.10		0.20–0.40	0.20–0.35		1.10–1.30	0.05 Max.	0.05 Max.		Normalize—Grind—Quench and draw to Rockwell "C" 62-65.
No. 7	Truck Rear Axle Housing—Furrow Wheel	1.35–1.55		0.90–1.10	0.40–0.60		0.08 Max.	0.10 Max.	0.08 Max.		Normalize to Brinell of 170-228.
No. 8	Crankshafts	1.35–1.60	1.50–2.00	0.85–1.10	0.70–0.90		0.40–0.50	0.10 Max.	0.08 Max.		1650 deg. Fahr. at heat 20 min. Air cool to a max. of 1200 deg. Fahr. Reheat to 1400 deg. Fahr. Hold for 1 hour. Furnace cool to 1000 deg. Fahr. Brinell 255-321.
No. 9	Piston	1.40–1.60	2.00–2.50	0.90–1.10	0.80–1.00		0.15–0.20	0.10 Max.	0.08 Max.		1650 deg. Fahr. at heat 20 min. Air cool to a max. of 1200 deg. Fahr. Reheat to 1400 deg. Fahr. Hold for 1 hour. Furnace cool to 1000 deg. Fahr. Brinell 190-228.
	Valve Insert	1.20–1.40	1.50–2.00	0.30–0.60	0.30–0.50		2.50–3.50			Tungsten 14.0–17.0	1450 deg. Fahr. at heat 30 min. Cool in 3 hours to 1000 deg. Fahr. Rockwell "C" 38-46.
	Valve	0.95–1.20		2.00–3.50	0.20–0.30		15.0–16.0			Nickel 14.0–15.0	

parts both in design and quantity requirements that they have been accommodated in a special, compact, department in the foundry machine shop division within easy reach of the source of supply of castings.

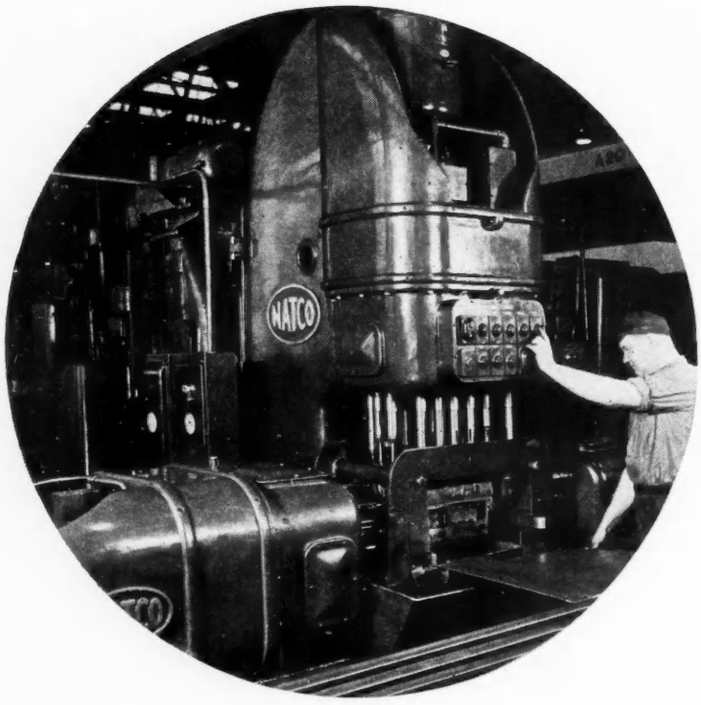
An interesting commentary on engine production is that engine assembly operations take place directly on the V-8 assembly line, without change of pace.

Modernization of equipment has been accented, as is wont in the Ford establishment with the launching of a new enterprise. The pictorial section of this article, as well as other details to be given later, provide a good perspective of the nature of many unique items of machinery and materials handling devices adopted for the machine lines and the steel foundry.

The main assembly operations have been concentrated in Building "B" where the offices of the Ferguson-Sherman organization are located.

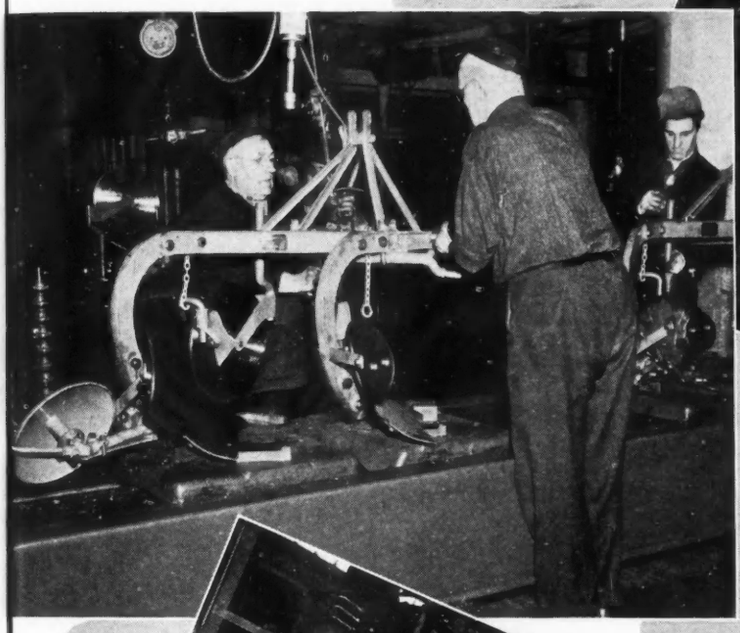
The tractor grows amazingly from its elementary sub-assembly—the axle shaft and driving disk—which are welded together, then fitted with various fastenings on a short mechanized assembly conveyor. Paralleling this is the first important sub-assembly mechanized conveyor line on which the axle housing is attached to the center housing, marking the beginning of the sturdy backbone.

The main assembly line traverses the side of the department, at right angles to the two auxiliary lines noted above, fed by four other



Three-way tapping machine takes 34 holes in one setting on the tractor cylinder block

At the right is shown an unusual feature of tractor manufacture is the mechanized assembly line for the assembly of plows and other implements. The view shows the initial steps, emphasizing the utilization of the platen as a massive jig for precise alignment of the parts of the system. The view below shows the final stages of implement assembly



Huge vertical boring machine for boring, chamfering, reaming, and facing operations on the center housing

auxiliary lines located further along at points of usage.

Completely assembled engines come in from the motor building and are stored in a bank feeding the motor accessories line where units such as ignition, mechanical governor, oil filter, etc., are installed. Similarly, transmissions are received in completely assembled state, stored in a bank, then fed to the third auxiliary line where engine and transmission are fitted together. These units are transported by hoist to the final assembly line.

Next is the sub-assembly of the steering gear and gear shift attachment which is prepared as a unit. Finally there is a department for the rigid inspection and assembly of the Ferguson hydraulic control pump unit which is tested and calibrated prior to assembly on the final line.

In following the operations on the final assembly line, we may note some of the major steps of the smoothly running process. First is the assembly of the rear axle and center housing; then the transmission and motor unit; then an interesting procedure for aligning the wheels and adjustment of tie-rods, using massive length gages to assure precise positioning.

At this point the tractor enters the water-wash spray booth containing two stations, one for each side of the machine. Upon emerging from the paint spray booth, the tractor moves through the ingenious baking oven consisting of a cylindrical shell of gold-plated reflectors fitted with infra-red heat lamps which dry the paint in four minutes.

At the end of the line, each machine is subjected to minute inspection including a final adjustment of the

This view shows the use of massive jigs on both sides of the tractor to assure proper alignment of front axle, locating from the rear wheel hub

governed engine speed, using an accurate tachometer. The tractors now are driven under their own power to an adjacent section of the department where they are turned over to the Ferguson-Sherman division for shipment to customers. Here they undergo a final inspection for acceptance; here, too, are made the final adjustments of the hydraulic mechanism to assure smooth functioning with implements attached.

A touch of the unusual is found in the high speed mechanized conveyor line for the assembly of plows and implements, probably the first example of its kind in the industry.

It consists of two independent sections, the first, for the assembly of single-bottom units, the second, for the final assembly of the two-botton implement. Each of the platens on the conveyor is designed as a precision gage so as to assure the proper alignment and interchangeability of the assemblies. The finished assemblies then are spray painted and ready for shipment.

Steel Foundries Procedures

In order to go into volume production of cast steel tractor parts, and to put some new ideas into practice, the Ford Motor Company revised and enlarged the steel foundry as part of a general foundry expansion program at the Rouge plant.

The main purpose of the revisions in the steel foundry is to permit steel castings to be poured continuously instead of intermittently as is ordinary practice. This was achieved by utilizing electric holding furnaces and conveyor reels which bring the molds directly to pouring spouts. The system not only saves time but also produces more uniform castings, because the metal for each casting is delivered at uniform temperature and is of uniform composition. Front axles, radius rods, steering sectors and wheel flanges are some of the tractor parts poured here.

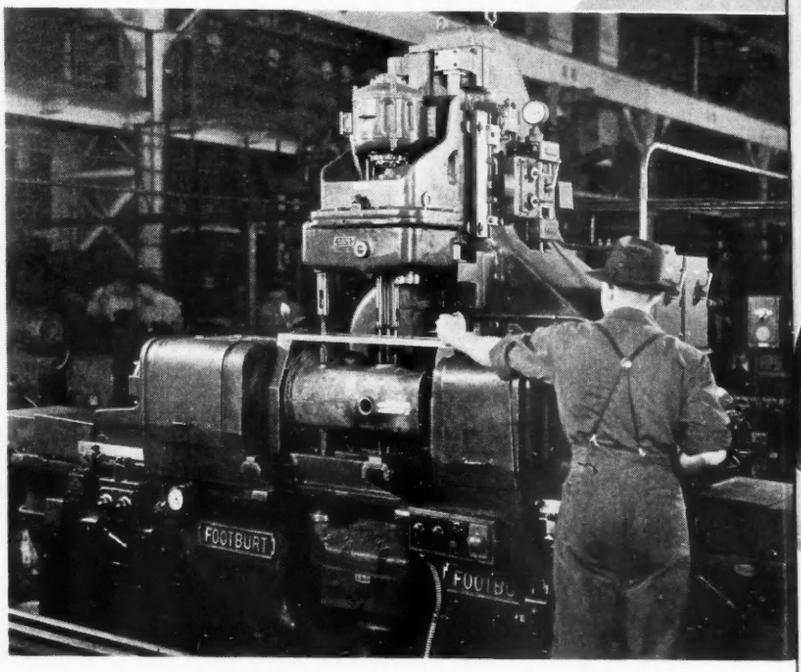
The metal is fed from a melting furnace into the holding furnace where it is kept at about 2950 deg. Fahr. The capacity of this unit is 80 tons in 16 hours.

In addition to the main melting and holding furnaces, there is a 2-ton cold melt furnace to permit running different analyses when the need arises. This, of course, lends flexibility to the system.

For the production of small tractor and car parts, there is a similar but smaller system. This unit consists of a reel which carries sand molds, made by vibrator molding machines, to a holding furnace where the molds are poured semi-automatically as in the case of the larger installation. A melting furnace supplies metal at the rate of 40 tons in 16 hours. The metal is transferred directly through a trough to the holding furnace. Clutch pedals, shifter forks, hydraulic lift arms and a dozen parts of similar size are made here.

The castings are shaken out, gates and riser are removed. The heat-treat furnaces are near the shakeout so that heat loss is minimized. Here castings are either quenched and drawn, or annealed according to the requirements of the individual part. Emerging from the heat-treat, they are cleaned and inspected.

Transmission case is drilled in this driller



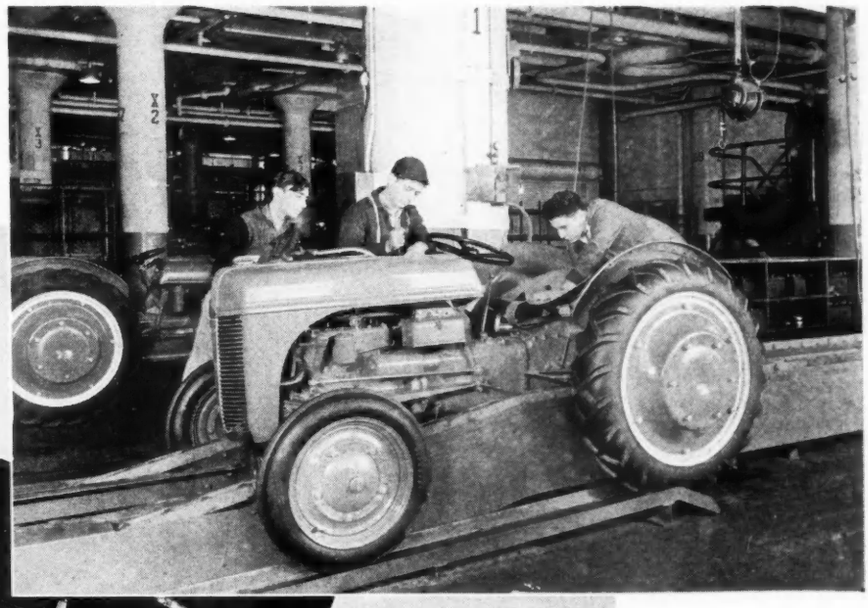
In addition to the foregoing is the equipment for centrifugal casting of gear blanks, first described in AUTOMOTIVE INDUSTRIES when the process was adopted for making passenger car gears. It is used for producing three tractor transmission gears and tractor main drive gear gears. Currently the equipment comprises four rotary casting tables, each carrying eighteen centrifugal dies. A 15-ton electric furnace feeds metal into a 10-ton holding furnace.

The top section of each centrifugal die is removable. A conveyor circulates spare dies supplying the rotary casting tables. This conveyor serves both for storage and for cooling.

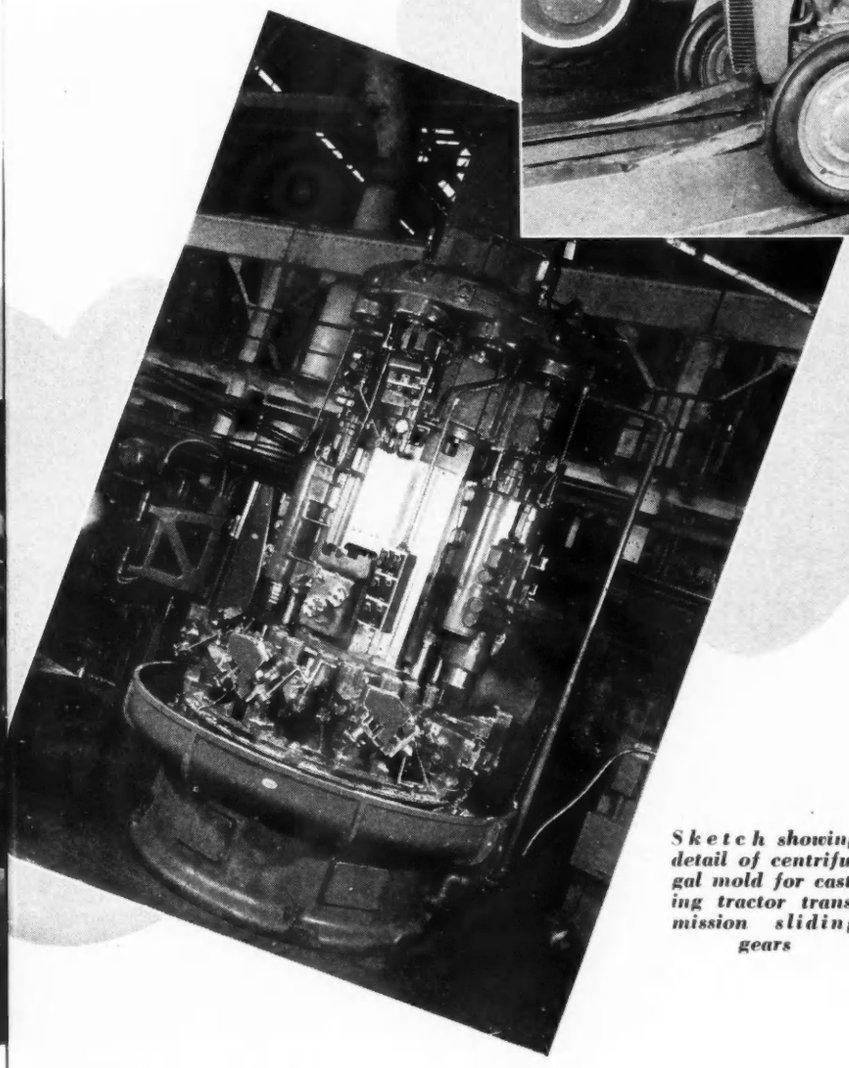
Gear blanks removed from the dies are placed on a floor level conveyor for transferring to the annealing furnaces. A feature of this conveyor is that it operates at slow speed, a sample fro meach group of castings being analyzed while the remainder is in transit.

Another recent development is the automatic crankshaft casting equipment. Both passenger car and tractor crankshafts are poured with this equipment, which consists principally of two continuous forehearth cupolas, an electric furnace, a holding furnace and a puring car such as is utilized on the cylinder block job in the gray iron section of the foundry.

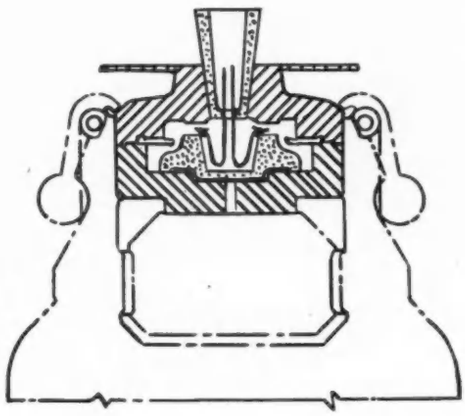
A distinctive development requiring special physical



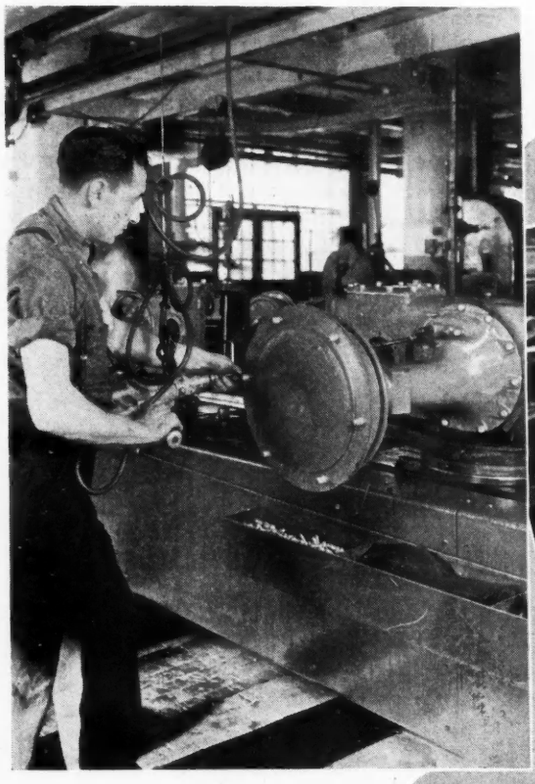
(Center below), Eight-station, center column machine with hydraulically operated indexing table, tooled for operations on the furrow wheel axle



Here is the finished tractor ready to come off the final assembly line



Sketch showing detail of centrifugal mold for casting tractor transmission sliding gears



Final stage of assembly line starts with the center housing which has been fitted with the hydraulic pump. Note that the work-holding cradle is of indexing type, permitting the operator to swing the assembly into position for attachment of right and left rear axle assembly

properties is the cast plowshare. This has to be extremely hard at the point but of a modified hardness in other sections. Good result has been obtained with steel specification No. 3 (see Table 1) with a special heat treatment.

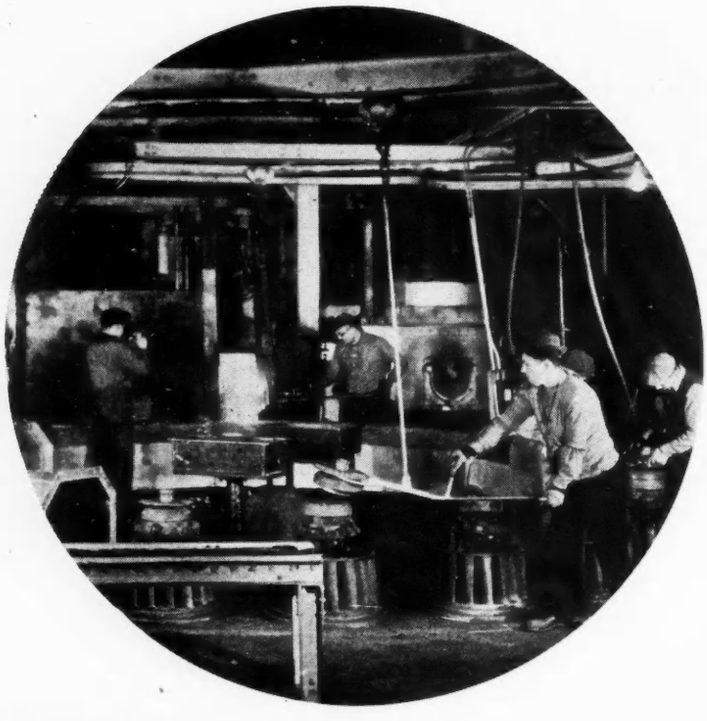
Cylinder Liner

The steel cylinder liner used in the tractor engine has many interesting features both in fabrication and in operating characteristics. It is formed by drawing from a lblank of low carbon, open hearth steel, 20-gage stock, but held within 0.040 to 0.45-in in thickness. One of the major advantages of the thin-walled liner is said to be its excellent conformity to the cylinder barrel, thus promoting a better fit and better heat conductivity. The very nature of the chemical surface treatment is said to increase resistance to wear and resistance to corrosion.

This powerful press is used for inserting the steel cylinder sleeves in the block

In fabrication, the liner is drawn in nine steps from a circular blank of the sheet steel. It is heat treated in a special oven employing a mixture of certain gases to produce the desired surface hardening which ranges from 1000-1100 Brinell. The bore and external surfaces are first sized by burnishing, then the internal bore is prepared for fitting in the engine by a honing operation.

The external surface which comes in contact with the cylinder bore is tin-plated to achieve ease of assembly due to self-lubricating properties of the coating, ease of removal since the coating prevents rusting or corrosion.



General view of one of the centrifugal casting units for producing tractor gear blanks

Selected Machine Shop Operation

As mentioned earlier, the machine shop equipment represents the very essence of mo-

dernity, accents many items specifically designed for the purpose. Many well-known machine tool builders are represented in this program. Here, for example, is a group of six machines built by W. F. & John Barnes. The first of these is a massive vertical machine, with extremely good looking lines, designed for boring, chamfering, reaming and facing operations on the center housing. It consists of a welded steel housing with a four-spindle indexing vertical head. In addition, there is a lower spindle of quill type driven from the vertical head.

The operator places the work in the fixture, operates the hydraulic clamping and cycle control, and the machine goes through the following cycle automatically, with a stop at the end of the cycle:

Station No. 1	Load and unload
Station No. 2	Idle
Station No. 3	Rough hollow mill and chamfer 2 spindles—1 rough hollow mill bracket end of axle 1 rough hollow mill and chamfer wheel end
Station No. 4	Semi-finish hollow mill 2 spindles—1 semi-finish hollow mill bracket end 1 semi-finish hollow mill wheel end
Station No. 5	Chamfer and face undercut 2 spindles—1 spindle chamfer and face bracket end 1 spindle undercut wheel end
Station No. 6	Finish hollow mill 2 spindles—1 spindle finish hollow mill bracket end 1 spindle finish hollow mill wheel end
Station No. 7	Burnish 1 spindle—burnish bracket end
Station No. 8	Idle

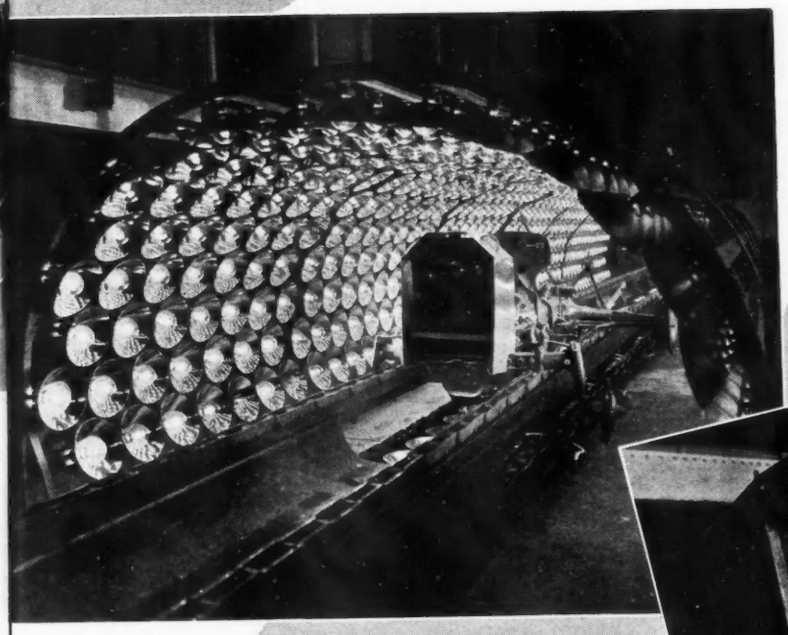
The other of the eight-station machines is set up to drill, bore, ream, and counterbore the front axle, handling both the right and left hand castings in the same setting. The sequence of operations is as follows:

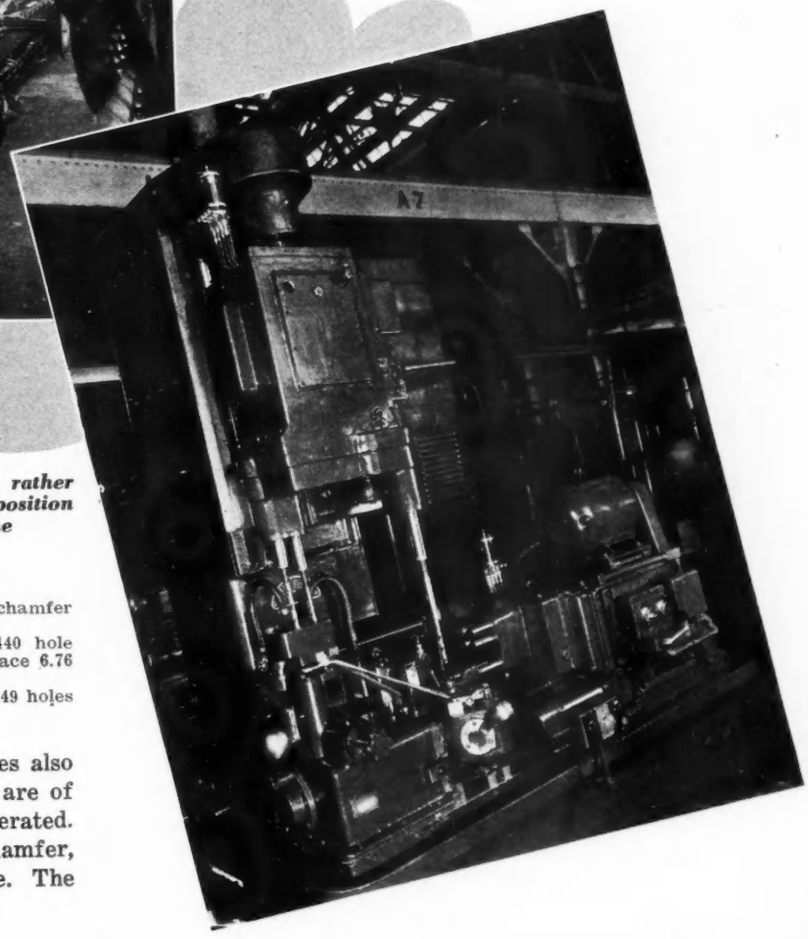
Station No. 1	Face—chamfer and rough counterbore top Face and chamfer bottom
Station No. 2	Core drill top and bottom
Station No. 3	Rough bore—counterbore and chamfer top
Station No. 4	Rough bore—bottom
Station No. 5	Semi-finish bore and semi-counterbore top
Station No. 6	Semi-finish bore bottom
Station No. 7	Finish counterbore top Ream top and bottom
Station No. 8	Load and unload

Another of the special machines in this

(*Turn to page 43, please*)

Infra-red lamp tunnels with gold-plated reflectors, characteristic of Ford practice, are employed for rapid drying of tractor assembly paint in stage shown here





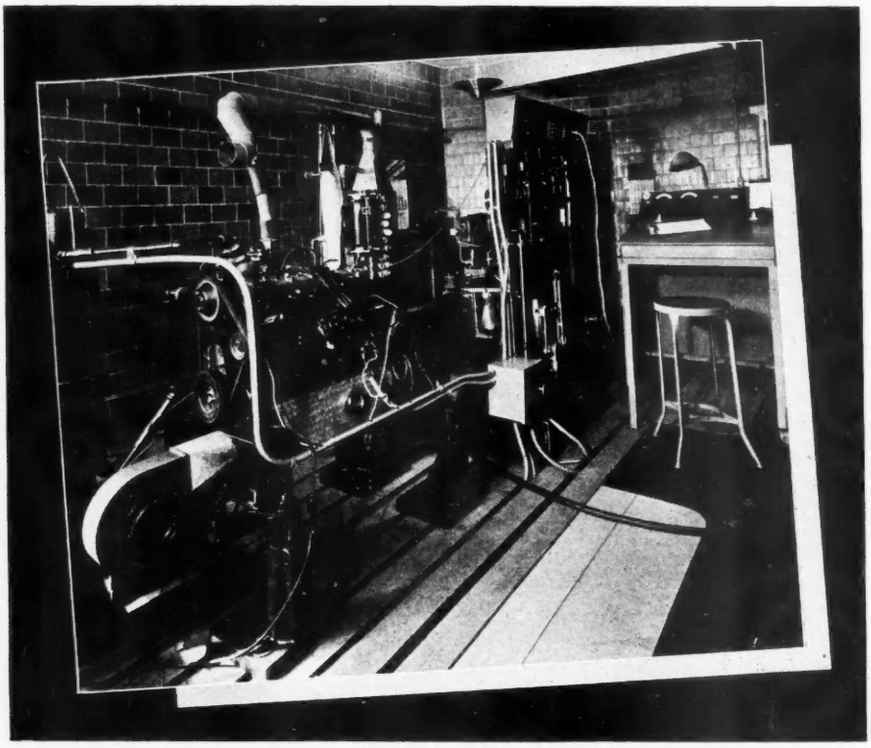
(Right) The implement V-strut, a rather difficult part to handle, is shown in position for drilling in a special machine

Lower spindle	Rough and finish bore and chamfer 3.500 inch hole
No. 1 upper spindle	Rough bore and chamfer 2.440 hole and 4.249 hole, rough spotface 6.76 dia.
No. 2 upper spindle	Semi-finish bore 2.439 and 4.249 holes
No. 3 upper spindle	Face 6.76 inch diameter
No. 4 upper spindle	Ream 2.439 and 4.249 holes

Two, eight-station center column machines also will be found here. The base and column are of cast iron, the index table hydraulically operated. One of these is tooled to turn, burnish, chamfer, and cut a relief on the furrow wheel axle. The sequence of operations is as follows:

Scope of Pure Oil Test

CONCERNED primarily with product development and consumer acceptance of The Pure Oil Company's products, the mechanical testing laboratories of The Pure Oil Company provide an interesting picture of modern research activity. Mechanical and Chemical Laboratories of the company are located in Northfield, Ill., about 20 miles north of Chicago, away from the disturbing influences of industrial activity. A new wing, added to the main structure, has widened the scope of the mechanical testing division, permitting it to concentrate on many special studies.



A view of 175 hp. eddy current dynamometer. Note the humidifier in place

It is an interesting commentary that many years of practical experience have influenced a philosophy of management in which mechanical research and testing have been integrated into a separate unit entirely independent of chemical research, although both departments cooperate closely on related problems. Each of the two major divisions has its own head—the Mechanical Laboratories being under the jurisdiction of Joseph A. Moller and the Chemical Division under William B. Ross.

Mechanical research centers principally on fuels and all types of lubricants and specialty products such as E.P. lubes, cutting fluids, etc. Quite naturally, its scope includes related studies of Diesel and gasoline engine performance; special problems such as hypoid gear lubrication; high pressure viscosity studies; fundamental bearing research; metal cutting and machinability; and road testing.

The new Mechanical Laboratory wing, comprising a first floor and a second floor addition, has had the benefit of the most advanced features of building construction. For example, each of the test rooms on the first floor, where heavy machinery is employed, is mounted upon an individual foundation slab, with enclosing walls well within the boundary of the slab. This serves to insulate each room from its neighbor, thus minimizing transmitted noise and vibration. Complete service facilities such as AC and DC current, compressed air, vacuum line, and hot and cold water—all are carried to each room in a floor duct from a central distributing station where each of the supply sources is automatically controlled and safeguarded.

An important feature of the new layout is the provision of an isolated drum shed for the storage of gasoline for general use, Diesel fuel, and small drums of reference fuels for special testing. Standard gasoline is stored in drums mounted in tiers, providing a supply of some 3000 gallons. A bank of about 15 reference fuels is carried in small containers, piped through individual lines to the test rooms.

The development of new products, the constant attempt to improve present products, and the comparing, testing and examining of the various accessories, other than tires and batteries, now handled by all major oil companies, comprises a goodly share of the work done by the mechanical laboratories.

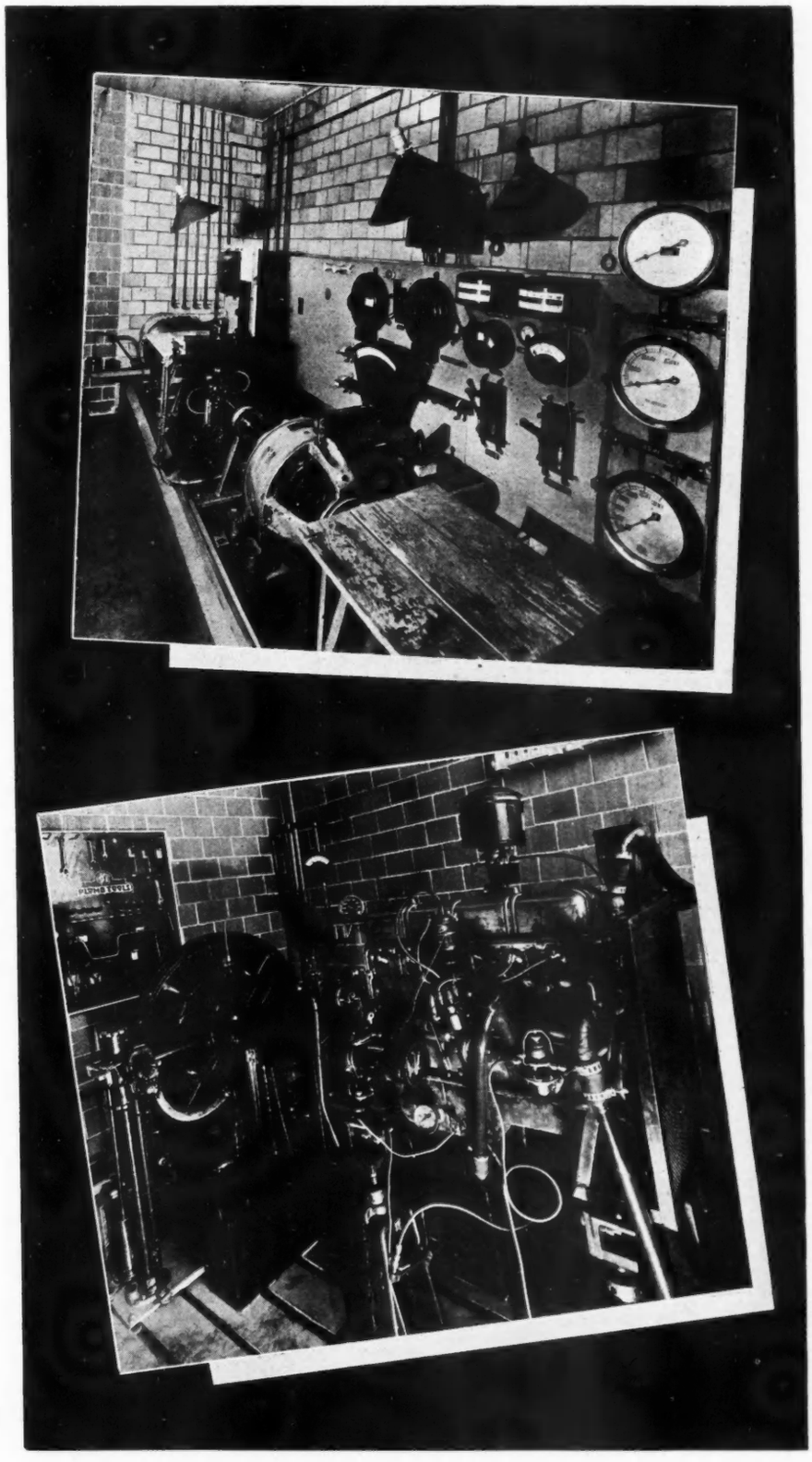
Perhaps one of the best ways to visualize a large portion of the work of the mechanical division is to consider it as an arbiter of consumer acceptance. To this end, there is a constant program of testing the product in regular production; of appraising improvements

Laboratories Broadened

and new developments in gasolines, lubricants, Diesel fuels, hypoid lubricants, and cutting fluids. In this, there is complete coordination of research divisions in the interest of the marketing division. In addition to the primary work of testing in the laboratories, field tests are carried on with a test fleet of some 11 passenger cars of current makes, at the laboratory. From here, a portion of company owned salesmen's cars, trucks, etc., is available for still more extensive field tests.

Laboratory test cars are serviced on a hydraulic lift of latest design, utilizing standard service station equipment. For special tests, the cars are provided with a portable test panel for recording unique test data while on the road. Initial adjustment on the cars, prior to the road work, are made with a portable Weidenhoff motor analyzer.

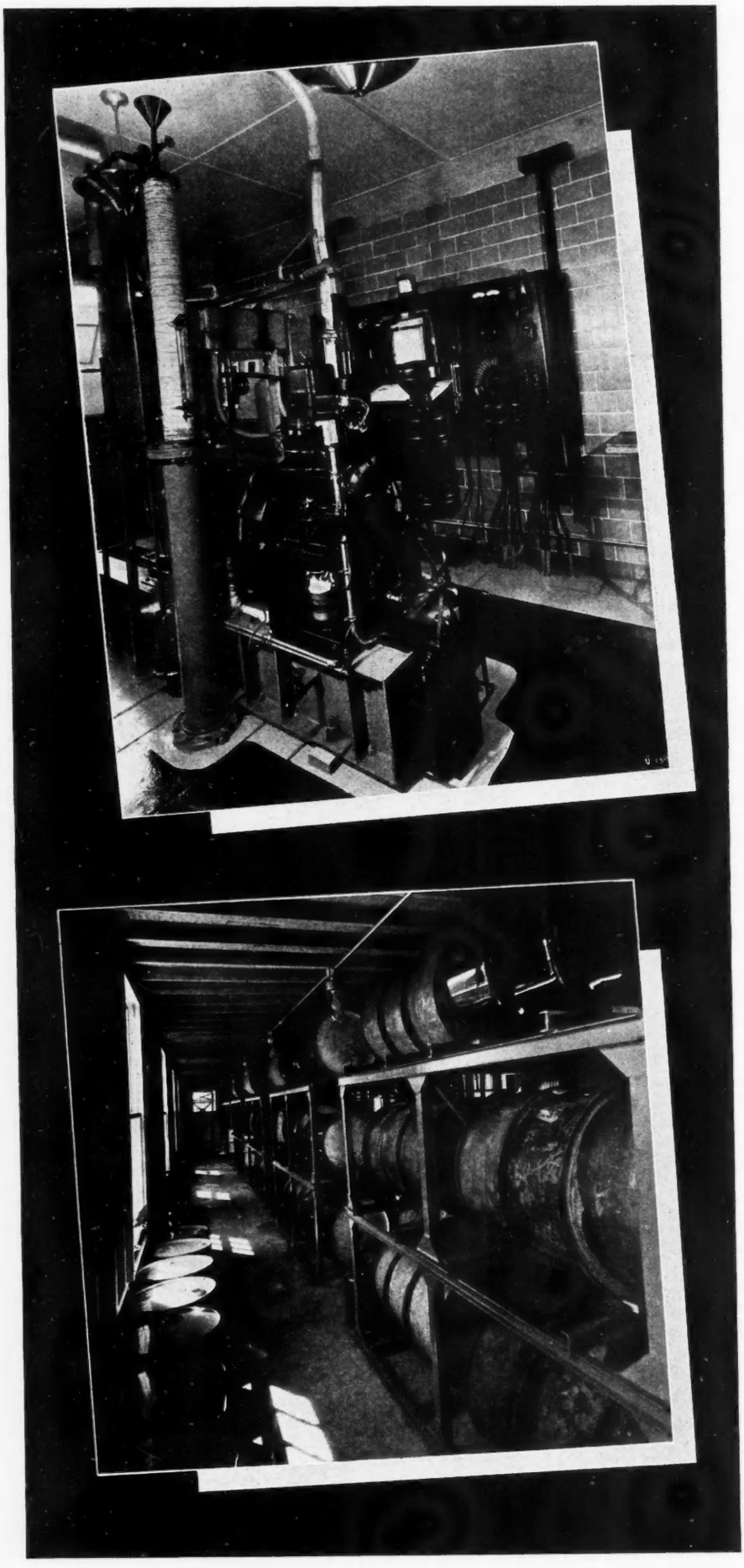
Excellent example of forward looking fundamental research is found in the current project for studying the behavior of fluids at extremely high pressures. For this purpose, there is a newly constructed high pressure viscosimeter of unique design. It is hoped that this instrument will provide the answer to many fundamental phenomena whose character and magnitude are unknown at the present time. When the project is under way it will be



A general view of a bearing and lubricant research machine

A general view of a set-up using water brake to absorb power output of the motor

TESTING



possible to correlate its results with studies being made on the bearing research machine which has been in operation for the past few years.

As an example of the fruition of research, we may note the project reported at the 1940 Annual Meeting of the SAE in Detroit, by Joseph A. Moller and Harry L. Moir, under the title—"Engine Deposits and the Effect of Some Fuel Additives." It summarizes the lengthy studies that were made on small single cylinder Lauson engines, on standard engines on the dynamometer, and in road cars, bringing to bear all of the facilities at their disposal including special testing and the preparation of samples by the chemical research division. End product was the successful marketing of a new line of gasolines blended with unique fuel additives which serve the function of solvents in the combustion chamber. As reported in the conclusion of the paper, the new fuels aid in maintaining a condition of minimum carbon deposition, resulting in a combustion chamber equilibrium having a salutary effect upon engine performance.

With this perspective, let us examine briefly the nature of the test facilities found in the new mechanical laboratory.

Starting with the second floor, there is a large room containing the new pressure viscosimeter. Next is a room devoted to cutting fluid studies. The latter is supplemented by a test room on the first floor, equipped with a big LeBlond lathe for studies of metal cutting machinability.

On the second floor, too, are found several rooms for the development of E-P lubes and a chemical laboratory for making

This is a view of a single cylinder Diesel test engine and dynamometer and its control panel

A general view of the motor fuel storage drum shed for reference fuels for the dynamometer and small engine work

This is a view of a single cylinder engine set-up showing engine and the control panel. Power is absorbed by means of small individual generators

up sample batches of E-P materials.

Heavy test equipment is located on the first floor. Here is a room with a large single-cylinder Fairbanks-Morse Diesel engine for Diesel lubrication studies. In this case the significant information sought for is the recording of temperatures at critical points—at the rings, piston dome, and cylinder head. For this purpose both the piston and head are fitted with a multiplicity of thermocouples, the leads being connected to a panel on the main control panel of the dynamometer. Each of the leads produces its own record on a Micromax recording instrument. Diesel fuel for each run is metered from an automatic scale which weighs pound by pound of fuel run.

Two of the new Midwest, hydro-electric, dynamatic machines have been installed recently. One of these is a 175-hp. machine; the other a 400-hp. machine. Each one is housed in a separate room and in each case the reference fuels are piped in from the outside drum shed.

An important piece of test equipment is the 125-hp. G.E. double-end electric dynamometer with a speed range of 6000 to 7500 r.p.m. This machine, as are the other dynamometers, is served by a portable humidifier with steam line connections and sensitive control for supplying intake air under standard conditions. The use of this technical apparatus makes it unnecessary to correct results for barometer or temperature or

Note the Timken machine, the S.A.E. machine, Faville-LeVally machine and the Chrysler thrust washer machine

A general view of 175 hp. electric dynamometer. This machine is capable of intermittent duty up to 7500 r.p.m.

humidity variations since these variables are all held within standard limits during the course of a test schedule.

Much of the routine fuel and lubricants testing is done on the familiar two ½-hp. single cylinder Lauson engines, each one connected to an individual generator. In this set-up such work is integrated in a single room containing a battery of 12 of the little units mounted on a long fabricated steel base.

Supplementing the E.P. laboratories on the second floor is an E.P. test room on the first floor, fitted with familiar test machines—including two Timken machines with automatic loading devices designed and built here; also an SAE machine with variable speed control, a Faville-LeValley machine, and a test machine employing thrust washers as test specimens.

Completing the main dynamometer facilities is a 150-hp. G.E. water brake which is used for routine engine testing.

In addition, there are two CFR test rooms but these, unlike the other equipment in the laboratory, are operated by the mechanical laboratory personnel primarily for the chemical research divisions. One of the test rooms has a single CFR Diesel unit; the other has three of the standard CFR single-cylinder gasoline engine units.

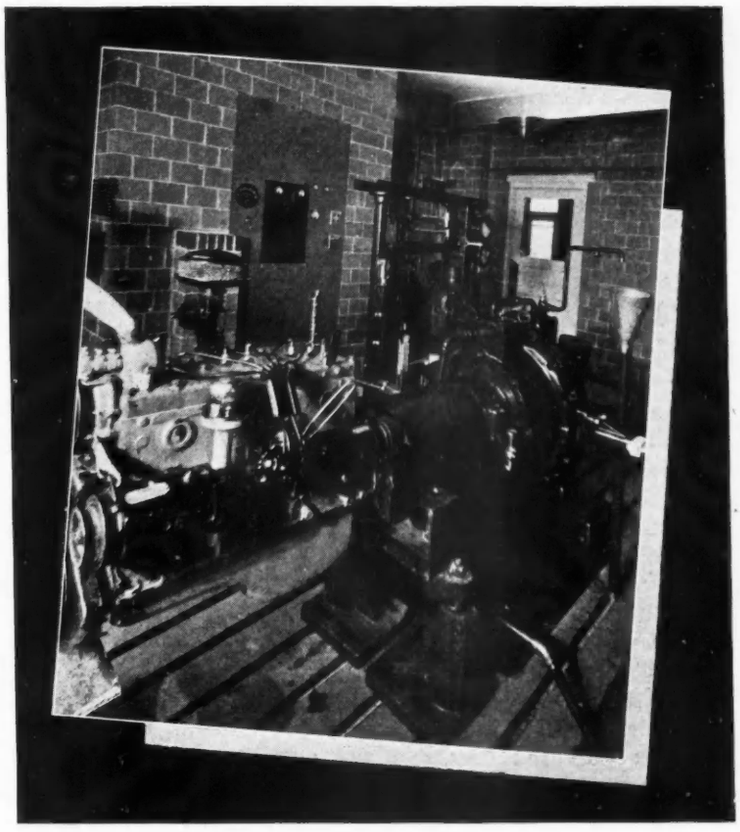
Beside the humidifier mentioned earlier, the dynamometer rooms have available several other pieces of portable equipment. One of these items is a portable table with special instrumentation for recording spark advance; another is a Weidenhoff motor analyzer which is used for engine tuning prior to starting a test run.

Perhaps the largest piece of equipment here is the bearing research apparatus designed for full scale testing of sleeve bearings. As illustrated, it comprises the bearing retainer at the center, a long line shaft with an accurately calibrated motor at the right and a calibrated generator at the left. The bearing cage is fitted with a bank of 24 thermocouples providing an accurate picture of the temperature gradient. In addition, the bearing cage has provision for hydraulic

The LeBlond lathe used in cutting oil research, showing a new test log in place

The pressure gauge indicates the pressure in the low pressure system and the Wheatstone bridge reads the pressure directly in the pressure viscosimeter itself, in which is the high pressure system

A general view of a single cylinder Diesel test engine and dynamometer and its control panel



loading to afford a wide range of pressures; and steam jacketing for imposing any desired temperature effects.

It is expected that the combined results of this apparatus and the new pressure viscosimeter will bring to light many of the unexplained phenomena encountered in highly loaded bearing operations.

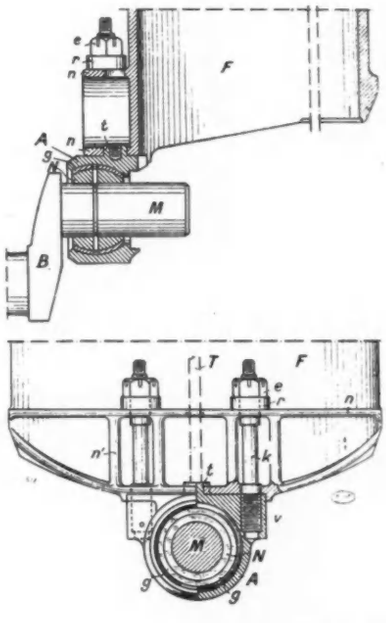
Thus it may be seen that with its present facilities, the mechanical laboratory is well equipped to serve the manifold functions of commercial testing, fundamental research, trouble shooting, and new developments.

The chemical laboratory fulfills the normal functions of that department, such as chemical research, refinery control, and refinery laboratory checking. The chemical laboratory, through its chemical engineering branch, is ideally equipped to initiate methods and processes for the manufacture of products developed by the chemical and mechanical laboratories.

Bristol Sleeve-Valve-Actuating Mechanism

CONSIDERABLE interest has been shown in aircraft-engine circles in the single-sleeve-valve engine developed by the Bristol Aeroplane and Motor Co. The valve mechanism is a development of that of the Burt-McCollum engine which at one time was used in automobiles by a number of European manufacturers. One of the problems connected with the design of this type of engine is that of a suitable driving mechanism for the single sleeve, to which must be imparted a combined oscillating and reciprocating motion. The drive employed by Bristol in its seven-, nine-, and fourteen-cylinder radial engines is illustrated by the two sectional views herewith, reproduced from *La Technique Moderne*. The drawings show a valve-actuating crankshaft with crank arm *B* and crankpin *M*, on which latter is slidingly mounted the inner member *N* of a spherical joint, the outer member *A* of which is rigidly secured to the valve sleeve at its lower end. The two members of the joint are separated by a lining of anti-friction material. While the outer member *A* of the spherical joint is shown in the drawing as being in a single piece, it would seem necessary to make it in halves in order to get the inner member into it. When the sleeve-actuating crankshaft rotates, member *N* slides on crankpin *M*.

The Bristol engines have cylinder barrels and cylinder heads of light alloy, the heads being secured to the barrels by studs and nuts. At the lower end of the valve sleeve *F* there are reinforcing ribs *n* of circular or elliptic shape, and vertical ribs *n'* extending between the former. The outer member *A* of the spherical joint is secured to the ribs of the sleeve by two stud bolts k screwed into part A and secured to the ribs on the sleeve by means of nuts and washers.



Valve - actuating mechanism of Bristol single-sleeve aircraft engine

An Anti-Knock and Carburetor De-Icing Fluid

ANILOL is an anti-knock and carburetor de-icing fluid that is being marketed by the Fuel Development Corporation of New York. It is intended for use in aircraft engines and consists of a mixture of aniline oil and various alcohols corrected for pH value. When mixed with motor fuel, each per cent of Anilol is claimed to increase the octane number by from one to three, depending on the lead content of the fuel. For example, an addition of 3½ gallons of Anilol to 100 gallons of 80 octane gasoline gives a fuel of 87 octane number.

Originally gasoline-Anilol mixtures were prepared to meet minimum octane-rating requirements of given aircraft engines. This, however, was found to be uneconomical, because under ordinary conditions of flight the engine operates at maximum output a small proportion of the time only, and under other conditions does not need to be supplied with a fuel of such high anti-knock value. This consideration led to the development of an octane-control valve which automatically supplies the Anilol in the correct proportion at the carburetor air intake when higher octane values are needed. Thus the airplane can be supplied with fuel of an octane rating only sufficiently high to meet ordinary cruising requirements. At take-off, when a better grade of fuel from the anti-knock standpoint is needed, requirements are automatically taken care of by the automatic valve.

The octane control valve incorporates an emergency control which serves the purposes of stabilizing engine temperatures and de-icing the carburetor when required. The former function is of particular importance in the event when a bi-motored plane has to be operated for a considerable period on a single engine, in which case the cylinder and oil temperatures are apt to become excessive. The emergency control then enables the pilot to supply Anilol at a greater than normal rate for a given throttle opening, thereby increasing the octane number of the fuel to meet these conditions. Anilol may be fed at a very high rate for a short time, and after the critical conditions have been eliminated the rate of feed may be reduced.

Carburetor de-icing is claimed to be effected much more rapidly with Anilol than by supplying warm air to the carburetor or by the use of alcohol alone. The Anilol is said to penetrate behind the ice formation and the metal almost instantly. In DC-2 operation, for instance, it is said to have been found that an inlet depression of ¾ in. of mercury column can be recovered in approximately 5 seconds, with the consumption of only 20 cc. of Anilol. Another advantage of the use of Anilol for de-icing as compared with heat to the carburetor is that whereas heat supply to the carburetor decreases the power of the engine and the ceiling of the plane, especially in the case of single-engine operation, with Anilol the regular ceiling is always available.

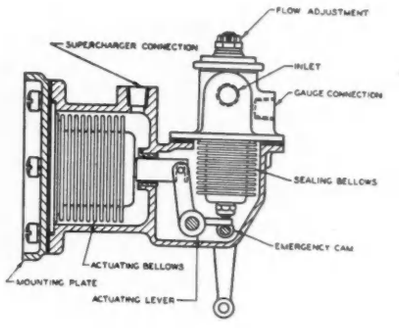


Fig. 2—Section of automatic valve

Anilol is supplied through the injection system illustrated in Fig. 1. The rate of flow is controlled automatically by the manifold pressure through an automatic valve. This valve (Fig. 2) was developed in order that installations might be made on aircraft engines having the automatic-mixture-control-type of carburetor. This valve depends on supercharger pressure alone for its automatic operation. The supercharger pressure acts on the actuating bellows, moving the drawbar and rotating the actuating lever. This lowers the valve stem and opens the valve, allowing the Anilol to flow at a rate that meets the specific conditions. The greater the supercharger pressure the more rapid the flow. Installation of the automatic valve is quite simple. It is connected by a ¼-in. tube to some point of the blower section. The valve weighs 2 lb. and the pump 5 lb. 5 oz.

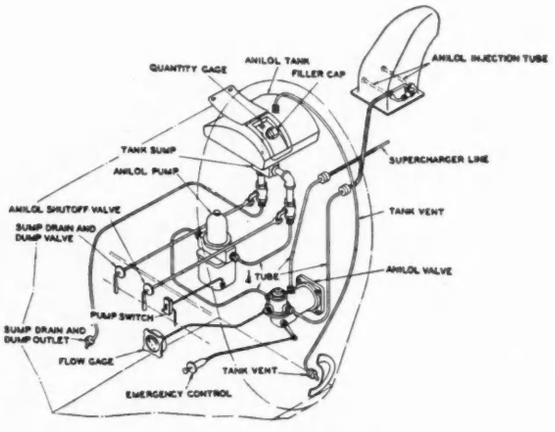


Fig. 1—Schematic drawing of an injection system

Design of High Speed, Two-Stroke Engines

By SCIPIONE TREVES, D.Sc., Mech. Eng.*

Section One

In this, the first of seven articles, the author classifies two-stroke engines for automobile and aircraft use, then discusses the advantages of the different types

AMONG the most interesting problems relating to combustion engines, especially from the point of view of an increase in their specific outputs and their weight efficiencies, is that of the theoretical study and the practical development of the two-stroke engine. In attacking this problem, engineers may profit by experience gained in the industrial field, where the two-stroke Diesel has supplanted the four-stroke type; and in the motorcycle field, where two-stroke engines have been evolved in a great variety of forms, more or less successful, but nearly always boldly and ingeniously conceived. Experience accumulated in these fields can be taken advantage of in the development of two-stroke engines for both automobiles and aircraft, with the idea of producing powerplants that, by reason of their smooth operation, simplicity and robustness, the absence of delicate parts such as valves and valve springs, and the much greater power developed per unit of weight and per unit of piston displacement, can compete successfully with the four-stroke type, which up to now has had the preference in these fields.

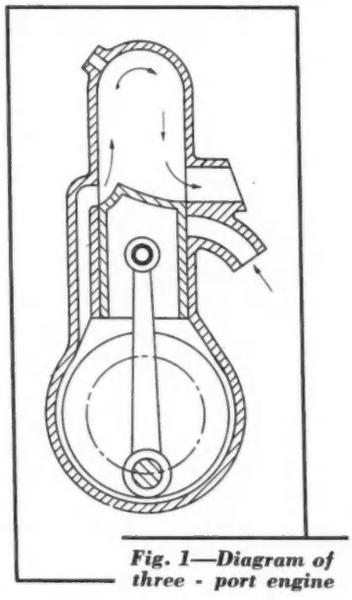


Fig. 1—Diagram of three - port engine

A rational classification of the various types of two-stroke engines may be based on the methods used for introducing the fresh charge into the cylinder, as in all types of engine the spent gases are discharged through ports provided for that purpose in the cylinder walls. There are two fundamental systems: In one the admission of the scavenging air and of the charge is controlled by the engine piston or pistons, while in the other this duty is performed by appropriate valves of either the poppet or rotary type. The former class may be again divided into two large classes, which together comprise all of the better-known types of two-cycle engine, i.e., three-port engines with deflector piston, and double-piston engines, which latter in turn may be subdivided into engines with double pistons in a single cylinder and engines with two pistons in U cylinders. The second system comprises (1) engines in which admission is effected by means of a valve in the cylinder head and (2) engines of the former type which, with the object of eliminating certain disadvantageous features, have been modified by the provision of auxiliary valving systems.

A brief critical enumeration of the various types, each of which may be scavenged either by a separate blower or by the engine crankcase, will suffice to bring out their respective advantages and disadvantages, from which conclusions may be drawn as to the best means toward their improvement. In the three-port system shown in Fig. 1 (which becomes a two-port construction when precompression of the charge takes place in a separate supercharger instead of in the engine crankcase), the piston while on the down-stroke, first uncovers the exhaust ports, and then, when the pressure of the burnt gases is reduced to slightly below that of the fresh charge, the inlet ports. Loss of fresh charge through the exhaust ports (short-

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circuiting of the flow) is prevented, at least to a certain extent, by the deflector formed on the piston head. The chief advantage of this type is its great simplicity, which is due to the small number of parts. This advantage, however, is accompanied by several disadvantages.

In the first place, in order not to reduce the expansion stroke too much, with consequent loss in power and efficiency, the exhaust ports generally are made too small. A high precompression pressure is then required, and this results in a notable loss in output. Inadequacy of port width is felt the more for the reason that the aggregate circumferential length of the ports must be much less than half the circumference of the cylinder, as the cylinder walls must not be weakened excessively. Unequal wear of the cylinder bore results from the reduced bearing area for the rings where the ports are located. A second series drawback results from the fact that during the upstroke, the inlet port is closed long before the exhaust, with the result that part of the fresh charge is expelled before the compression period begins. This explains why it is that only very low mean effective pressures can be obtained with this type of engine, and the dimensions and weights of such engines are quite out of proportion to the power developed. This is further aggravated by the fact that the crankcase, in which the precompression takes place, is not completely filled during its suction period, owing to the wire drawing effect of its inlet valve, and also because the charge is considerably heated while entering the engine through its contact with moving parts, and especially with the piston.

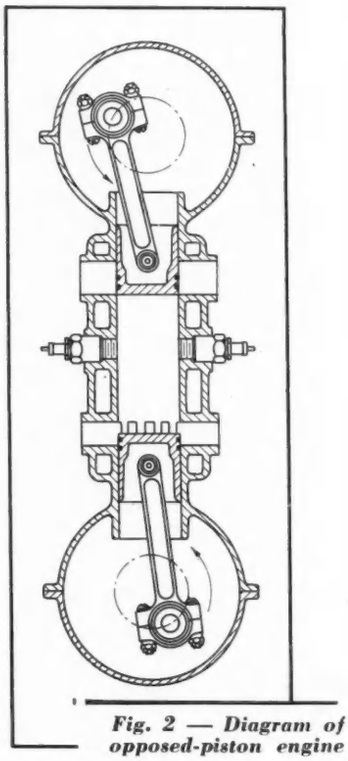


Fig. 2 — Diagram of opposed-piston engine

The second class of this type of engine, as already mentioned, requires the use of two pistons, which are either opposed in the same cylinder (Fig. 2) or located in two parallel cylinders (Fig. 3). The use of two port-controlling pistons, as originated by Oechelhäuser in his historic gas engine and subsequently developed by Junkers in Germany and in the well-known Doxford and Cammellaird-Fullagar marine engines in England, presents notable advantages, from the mechanical and thermal as well as from the operating standpoints.

An advantage from the mechanical point of view is that if the cranks are so set that the two pistons are in phase with each other, the moving masses may be perfectly balanced, which permits of operating the engine at higher angular speeds. This advantage is of particular importance for the reason that, since communication between the crankcase and the exhaust pipe at any part of the cycle must be prevented for obvious reasons, the piston controlling the exhaust ports must be longer than the stroke, which necessitates the use of long and heavy pistons. A second advantage of a mechanical character is the absolute symmetry of the piston, due to the absence of a deflector, which latter, because it displaces the center of gravity of the piston from its longitudinal axis, and because of the necessary clearance between piston and cylinder, often gives rise to lateral oscillations of the piston, resulting in a characteristic knock, which can be prevented only by balancing the piston, that is, by making it still heavier.

From the production point of view, this engine has the advantage that it does away with the cylinder head —always a complicated and troublesome part—which is replaced by the second piston. The cylinder, moreover, since it is of uniform thickness throughout, can be more readily cast in either iron or aluminum, for use with a removable liner; and it can also be simply made of steel, if it is desired to use that material.

From the thermodynamic standpoint there is, first of all, the great advantage of a combustion chamber of excellent shape. The latter has only a very small cooling surface, made up of a narrow strip of cylinder wall and of the two piston heads, and it is devoid of any valve pockets or recesses which might hinder free flow of the gases during the combustion period, so that combustion can be effected with the greatest rapidity. Secondly, since in this engine a very long effective stroke, corresponding to a better utilization of the expansion, may be combined with a high speed of rotation, the expansion is more rapid than in single-piston engines and the heat losses to the walls during the expansion stroke are therefore considerably reduced. Moreover, as will be shown in Section 3, since in this type both the inlet and exhaust ports extend all the way around the cylinder, the necessary port areas are easily obtained with comparatively narrow ports, so that the loss of effective expansion due to the ports is decreased. The greater effective expansion ratio results in a higher thermal efficiency.

This arrangement also has the advantage of admission of charge symmetrical with respect to the axis of the cylinder, which reduces the chance of intermixing of the fresh charge with the spent gases at the beginning of the scavenging period. Finally, the absence of reciprocating or oscillating parts, such as valves, which must be provided with cooling means, and also the absence of heavy metal sections which might cause overheating, permit of the use of relatively high compression ratios without risk of preignition or detonation. When use is made of antidetonating fuels (usually of the leaded type), these conditions permit of the use of compressions higher than in any other type of engine, provided other thermal conditions are the same.

In addition to these various advantages, the double-

piston engine possesses another functional characteristic which clearly distinguishes it from other types and forms, perhaps its most essential feature, viz., uniflow scavenging. The scavenging air or the fresh mixture, passing through the cylinder in one direction only, the admission being at one end and the exhaust at the other, acts like a fluid piston on the burnt gases. Consequently, there is much less chance of the fresh gases mixing with the burnt gases, and the loss of fresh charge through the exhaust ports may be reduced by proper port timing.

The disadvantages of this type are practically limited to the complication of the design due to the use of two crankshafts, the use of a single crank with long and short connecting rods (as in the old Oechelhäuser) being impractical because of the high speeds desired and the large number of cylinders in modern engines. Moreover, owing to the use of two crankshafts, means such as spur- or bevel-gear trains must be provided for connecting them, and also two crankcases with their supports and bearings. However, in the case of an automobile engine, this apparent drawback leads to a more rational use of the space available for the engine, as with the usual form of radiator the height of the space under the hood is always much greater than required for the engine (especially with the miniature engines of European popular-priced cars —Editor), and the opportunity is offered of reducing the length of the engine compartment.

Finally it should be pointed out that, owing to the limited area of the water-cooled portion of the explosion-chamber wall, high operating temperatures of piston heads and spark plugs must be expected. Energetic cooling means must be provided, especially for the piston heads, along the lines followed for some time in connection with large two-stroke engines operating on the Diesel cycle.

The remarks made with respect to the type illustrated in Fig. 2 apply in general also to the type shown by Fig. 3, which is derived from the former by swinging half of the cylinder through an arc of 180 deg. around the combustion chamber. In fact, this type may be regarded as a three-port engine in which uniflow scavenging is obtained by replacing the deflector on the piston head by a fixed deflector forming part of the cylinder. This results in a much more compact design, and it also leads to the use of a single crankshaft, which is made possible by certain expedients, such as the use of a special connecting rod with a forked small end, each of the prongs being connected to one piston, as in some well-known motorcycle engines.

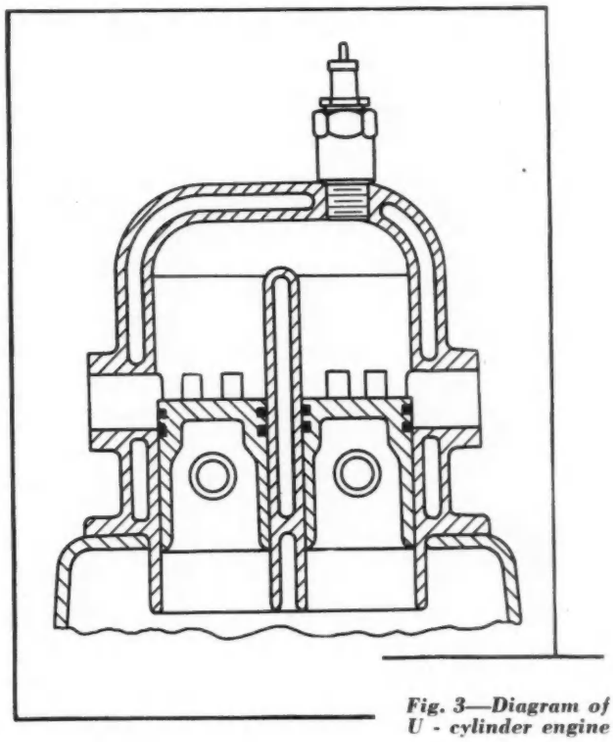


Fig. 3—Diagram of U - cylinder engine

On the other hand, some of the most notable advantages of the double-piston engine are lost, the particular ones which tend to make high speeds possible. In fact, the reciprocating masses, although always quite large, are no longer balanced and give rise to serious inertia forces. Besides, although the scavenging is still of the uniflow type, there is a sudden turn in the path of flow in the combustion chamber, and the flow therefore is not as free as in the former case. Finally, the combustion chamber is rather complicated in shape and—other conditions being the same—presents a larger surface to the action of the cooling water. Moreover, if it is desired to use a high compression ratio, the combustion chamber assumes a shape none too favorable to gaseous flow during the scavenging period. In any case, the heat released by the combustion is not nearly so efficiently utilized, and the engine therefore is less suited than the preceding type for the generation of large specific outputs.

The second type of two-stroke engine, in which gas flow is controlled by mechanically-actuated valves, is not nearly so attractive as the first, as one of the chief advantages of the two-stroke over the four-stroke engine is the absence of these very parts, and more especially the valves and their springs, which not only represent a considerable complication, but also are an obstacle to the attainment of high rotary speeds, which are essential to the production of high specific outputs. Where one or more valves are located in the cylinder head, these disadvantages are even more severely felt, in the first place because such valves, in order to afford the necessary flow areas, must be large and heavy; and since they must open and close during a time interval corresponding to 90 deg. of crank motion, they require very powerful springs, which are apt to give trouble from surge. Secondly, because the valves must be lifted once every revolution of the crankshaft, or twice as often as in the four-stroke engine, the number of stress cycles in the springs and other parts is doubled. In spite of the considerable advantages offered by these types—among them the possibility of using one valve for scavenging air and another for the admission of combustible mixture, the scavenging valve being opened only after the gaseous pressure in the cylinder has dropped below that of the

scavenging air and the mixture valve being kept open until after the piston-controlled exhaust port has been closed—it appears, nevertheless, that this type of engine has little to recommend it for development as an automobile engine.

As to the other class, that is, engines of the first system with the addition of separate valves, which generally would be of the rotary type, for the admission of scavenging air and mixture, this would necessitate considerable complication of the engine and call for the solution of some difficult design problems, especially important among which is that of preventing the leakage of gasoline and lubricating oil, present, respectively, in the ports and in the bearings of the rotary valves. It will be well, however, to judge the importance of the disadvantages of this arrangement in each individual case, on the basis of the results which may be obtained; and in each case the decision must of necessity be subordinate to the choice of the type of engine previously made.

* * *

This rapid review of the principal types of two-stroke engine suffices to make it clear that the double-piston type is the one which best lends itself to the attainment of high speeds and high specific outputs, for the reasons outlined in the foregoing, principally the uniflow scavenging, the particularly favorable shape of the combustion chamber, and the perfect balance of the moving parts. And it is the double-piston type of engine to which engineers and designers have devoted most of their attention in recent years, in an endeavor to increase its specific output, render its scavenging operation more effective, and to diminish its specific fuel consumption.

From the standpoint of increased output, the most notable improvement was made by the introduction of supercharging by means of special rotary blowers driven by the engine.* Theoretical and experimental studies of four-stroke racing engines have led to the application of superchargers handling combustible mixture, with which the pressure in the cylinder at the beginning of the compression stroke already is considerably above atmospheric pressure, with the result that the mean effective pressure is greatly increased and the results are much better than those from a cycle without supercharging.

From supercharging of four-stroke engines it was only a small and easy step to supercharging of the two-stroke type, which operates on practically the same thermo-dynamic cycle and which has an inherent need for a blower, as the suction stroke is missing†.

As to the choice of the type of supercharger, the piston type is excluded for obvious reasons. Engineers have made a careful study of the various rotary types, including centrifugal, vaned, and Roots blowers, all of which are adapted to deliver large quantities of gas at the moderate pressures required for this work. The supercharge pressure must not exceed certain limits, which practice indicates to lie between 0.3 and 0.5 atmospheres, as with excessive pressures there is danger of blasts of combustible gas passing right through the mass of inert gases from the inlet to the exhaust ports, and, besides, the temperatures of explosion and expansion are raised and this may lead to difficulties with spark plugs and pistons.

Improvements made in the timing of the engine cycle are directed chiefly to obtaining a delay between the opening of the exhaust and that of the inlet port. It is the general opinion that to ensure good scavenging, the inlet ports must be opened only after the cylinder pressure has dropped to the pressure of the scavenging air at the inlet ports. In other words, the counterpressure of the burnt gases should equal the pressure at the outlet from the supercharger minus the pressure drop in the piping and the inlet ports. To this end, either the exhaust ports are made higher than the inlet ports, or the pistons controlling the exhaust and inlet ports, respectively, are thrown out of phase, the former being given an advance over the latter. The second method is readily applied to engines with two crankshafts, the crankshaft on the exhaust side being given an advance varying from 15 to 25 deg., depending on the speed of the engine; and also in double-piston engines with parallel

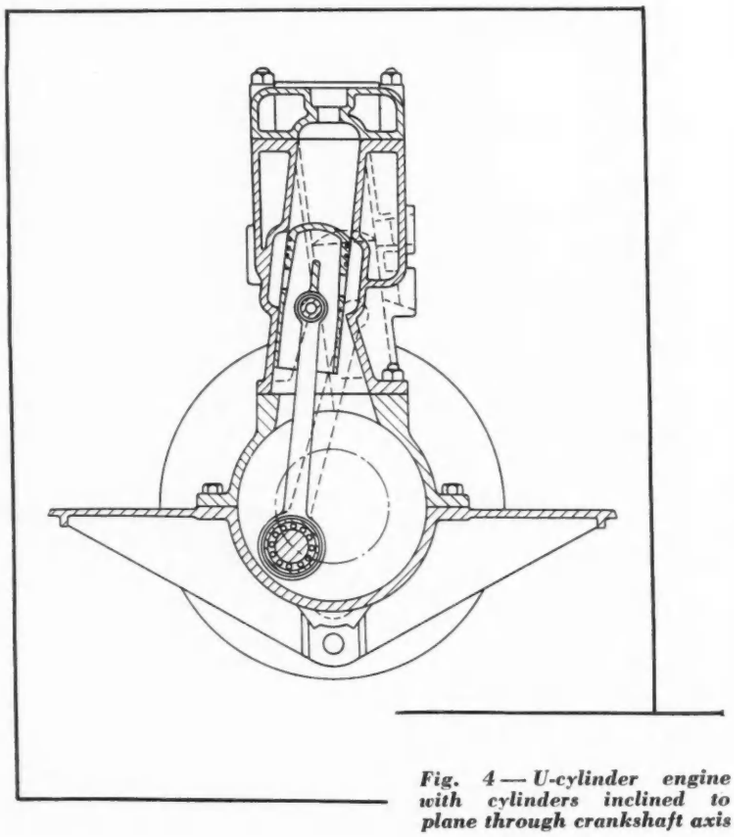


Fig. 4 — U-cylinder engine with cylinders inclined to plane through crankshaft axis

* See S. R. Treves, "Supercharging Investigated from the Thermodynamic Standpoint," AUTOMOTIVE INDUSTRIES, June 10, 1926.

† In this connection it is well to remember that supercharging has been used with satisfactory results on a number of two-stroke Diesel engines. One of the most outstanding applications of two-stroke engines with superchargers is on the "Aorangi," a quadruple-screw liner of 23,000 tons displacement, equipped with four two-stroke, six-cylinder Sulzer Diesel engines developing a total of 13,000 shaft hp. at 127 r.p.m. The scavenging and charging air is supplied by two centrifugal blowers each capable of delivering 34,000 cu. ft. of air per minute against pressures of 1.75-2.10 lb. per sq. in., while a third unit acts as a standby.

cylinders, where a special form of forked connecting rod may be used, or the crank pins connecting to the pistons in one set of cylinders may be displaced with relation to the other crankpins.

For engines that are to operate at very high speeds, recourse must be had to both of the above methods. This is so especially because with a symmetrical timing diagram, having the exhaust ports higher than the inlet ports involves the disadvantage that the inlet ports are closed ahead of the exhaust ports, whereas it is evidently preferable to have the inlet ports close last, both with a view to preventing the loss of mixture through the exhaust ports and to making it possible to have a pressure in the cylinder at the beginning of the compression period which is equal to the blower pressure. A combination of the two methods of correcting the timing diagram is of advantage also in that, on the one hand, the exhaust ports cannot be made excessively high, and thus a disproportionate portion of the power stroke lost; and, on the other hand, the phase displacement of the two sets of pistons cannot be made excessive, which would result in dangerous back pressures at the time of explosion.

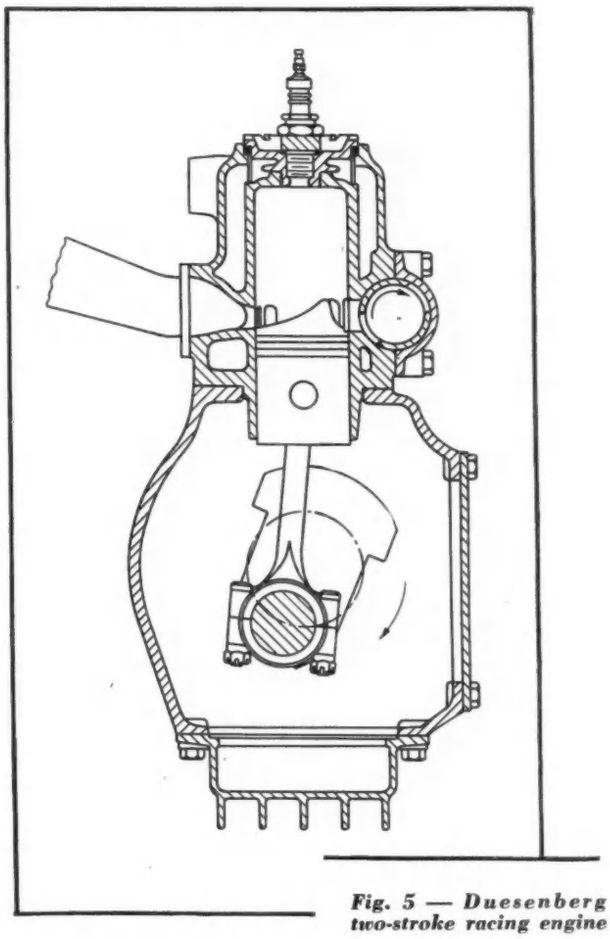


Fig. 5 — Duesenberg two-stroke racing engine

Another interesting method of obtaining the desired phase displacement is by sloping the two cylinders of a pair with a common combustion chamber, as shown in Fig. 4, connecting both pistons to the same crankpin. This possesses the further advantage that one piston is in advance of the other only in bottom dead center, the two being in phase in top dead center, thus avoiding the difficulty due to one piston being behind and the other ahead of dead center at the time of explosion, as with other systems of phase displacement. This system, however, does not lend itself to great phase displacements, as required for engines of very high speed.

It should also be pointed out that while in the case of engines operating at substantially constant speed, such as aircraft engines, a phase displacement which cannot be changed while the engine is in operation is quite satisfactory, with experimental engines and with engines which are required to operate throughout a wide speed range, it is natural for the designer to try to provide means to vary the phase difference in accordance with the engine speed, so as to have the most favorable operating conditions at all speeds. This improvement may be achieved in two-crankshaft engines by interposing between one of the crankshafts and the gear connections between the two shafts a mechanism similar to that employed for changing the timing of magnetos but, of course, sufficiently strong to be able to withstand the much greater loads. The effort necessary to change the phase difference may be reduced by means of suitable leverage.

The methods resorted to with a view to increasing the mean effective pressure, as enumerated in the foregoing, viz., the use of superchargers, improvement in the timing diagram by phase displacement of the two pistons in each cylinder, and enlargement of the exhaust ports with relation to the inlet ports, led to the development of the first two-stroke engines for automobiles and marked a real step in advance in this field of new studies and fruitful applications.

Without dwelling on the earlier experimental attempts, like those of Junkers, who built a two-stroke, opposite-piston-type airplane engine during the World War; of Zoller, who foresaw the use of turbo blowers as a means of precompressing the mixture and improving the evacuation of the burnt gases; of Messpa, whose airplane engine had two vertical cylinders with four pistons, two and two opposed, a row of exhaust ports in the lower part of the cylinder and one of inlet ports in the upper part, and which used the two crankcases as charge pumps or blowers; and omitting mention of several other types of which descriptions may be found in handbooks and in the patent records, it is advisable to deal briefly with the Duesenberg engine which figured in the Indianapolis race of 1926.

This engine, designed by the late Fred Duesenberg and built by Duesenberg Motor Company of Indianapolis, had eight cylinders in two blocks of alloy cast iron. It had two sets of ports, exhaust and inlet, the inlet ports being connected to the supercharger delivery through a pipe. Admission of charge was controlled by a rotary valve so that, although the inlet ports were higher than the exhaust, the former always opened and closed after the latter. Bore and stroke were 2-5/16 and 2-3/4 in. respectively, which made the displacement 91.5 cu. in. The supercharger used, the same as that on practically all other American super-

charged engines, was of General Electric manufacture, of the centrifugal type, and rotated at between five and six times crankshaft speed. Pistons were provided with very high deflectors, owing to the great height (even in this early engine) of the inlet ports. Ignition was by means of the battery-and-coil system. The rotative speed was not very high when compared with that of contemporary four-stroke racing engines, but at 4800 r.p.m. the engine developed 115 hp., corresponding to a b.m.e.p. of 102 lb. per sq. in.

It is worthwhile also to mention an Italian experimental engine built especially for racing and illustrated diagrammatically by Fig. 2, which has six individual steel cylinders of 2.045 in. bore, each cylinder containing two pistons of 2.30 in. stroke, which corresponds to a displacement of 91.5 cu. in. The engine is supercharged by means of a Roots blower turning at engine speed, and has two crankshafts connected by four spur gears which are also used for auxiliary drives. There are two oppositely-located spark plugs in each combustion chamber, intended to ensure a more rapid and symmetrical combustion, and greater homogeneity of the charge immediately after explosion. In tests this engine showed an output of 170 hp. at 6000 r.p.m., corresponding to a b.m.e.p. of 121 lb. per sq. in. To judge this performance it should be remembered that a four-stroke stock engine of 91.5 cu. in. (1.5 liters) displacement ordinarily does not give more than 30 to 35 hp., and this output is attained only after careful tuning. In comparing the b.m.e.p. figures it is well to remember, moreover, that the figure for the four-stroke engine was obtained from the equation

$$\text{B.M.E.P.} = 780{,}000\frac{\text{Hp.}}{\text{N D}}\text{lb. per sq. in.}$$

where N is the speed of rotation in r.p.m and D the piston displacement in cu. in., while the values referring to two-stroke engines were calculated from the equation

$$\text{B.M.E.P.} = 390{,}000\frac{\text{Hp.}}{\text{N D}}\text{lb. per sq. in.}$$

in which the numerical coefficient is only one-half as large as in the preceding equation. A more direct comparison can be made on the basis of the engine torque, which, as is well known, is given by the equation

$$\text{T} = 5200\frac{\text{Hp.}}{\text{N}}\text{lb.-ft.}$$

(The numerical coefficients in the above three equations apply when the horse powers are given in metric units of 75 kilogram-meters per second. If American horse powers of 33,000 ft.-lb. per minute are used—which are about 1.5 per cent larger than metric horse powers—the proper values of the coefficients are 792,000, 396,000 and 5250 respectively.—Editor)

These rapid observations regarding a few of the engines built during the past several years are sufficient to show the great importance of the problem of the two-stroke engine. If a rational and economical solution of this problem were reached it might revolutionize the entire field of the explosion engine. It is certain that the very high specific power and the high torque even at speeds far below that corresponding to the rating, make the engine highly suitable for racing purposes and fighting planes. But in order to make possible a wide commercial use of this type of engine it is necessary to try to lower its specific fuel consumption so it will be no greater than that of the four-stroke engine.

Some engineers are of the opinion that the solution of this problem lies in direct injection of fuel into the cylinders at the end of the scavenging period, scavenging being effected with pure air. But this solution of the problem encounters grave difficulties, chief among which is that of building an injection pump for gasoline that is capable of injecting during every crankshaft revolution the very minute quantity of fuel required by engines of this type. For this reason, at the present time the opposed piston engine with two rows of ports, for inlet and exhaust respectively, and with a rotary supercharger seems to offer the greatest chance of attaining—when skillfully designed—that clear superiority in respect to specific power and fuel economy which, coupled with its mechanical simplicity and its possibilities with respect to operation at high speeds, should lead to its gradual ascendency over the four-stroke type in many fields of application.

In the meantime a study of the stratification of mixture in these two-stroke supercharged engines, of the thermodynamic cycle on which they operate, and, lastly, of methods of calculating the more important characteristic dimensions, particularly the required heights of inlet and exhaust ports, should prove of interest.

Section Two
of this treatise on engine design will appear in an early issue of AUTOMOTIVE INDUSTRIES

Change of Calibration of Thermocouples

A paper by A. I. Dahl (RP1278) in the *Journal of Research* for February presents data concerning the stability of Chromel-Alumel and iron-constantan thermocouples used under certain controlled conditions. Thermocouples of various sizes from 0.025 to 0.128 in. in diameter (No. 22 to No. 8 gage) were exposed to temperatures ranging from 800 deg. to 2200 deg. Fahr., in steps of 200 deg. Fahr., in an atmosphere of clean air. Determinations of the changes in calibration were made after fixed periods of heating over a total heating period of 1000 hours, or as long as the thermocouples remained serviceable. The results are presented chiefly in the form of graphs showing the changes in calibration as related to the length of time in service. Certain precautions to be followed in the use of thermocouples in order to obtain the most reliable results are discussed.

LONDON-BUS TYPE A. E. C. DIESEL ENGINE

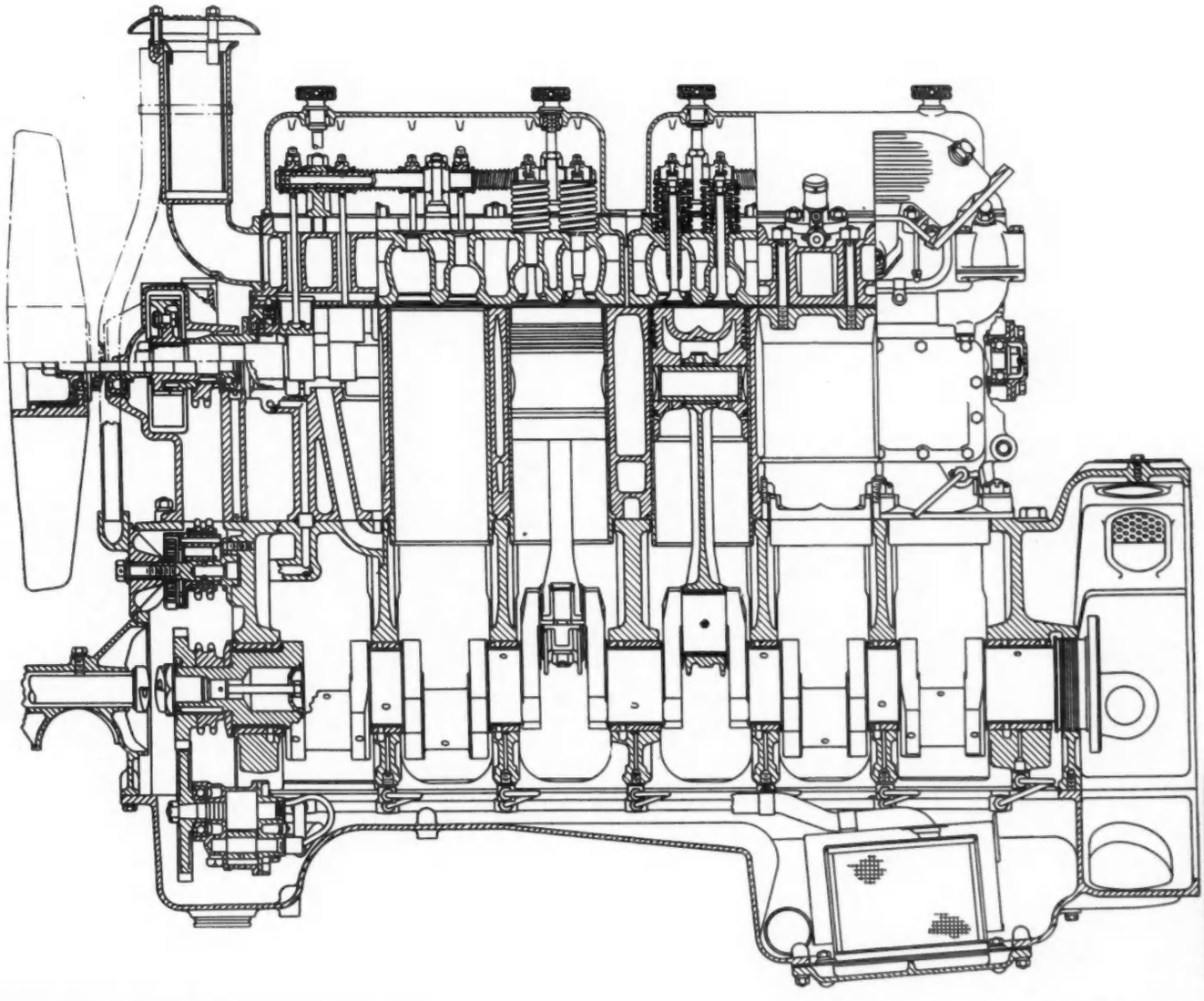
Longitudinal Section

The latest type of London double-deck buses carry the A.E.C. direct injection Diesel engine shown by the accompanying drawings. This same engine also is optional equipment on A.E.C. heavy trucks and buses generally.

With six cylinders and a bore and stroke of 4.13 by 5.75 in. (462 cu. in. displacement), the peak output is 113 hp. at 2000 r.p.m., though the governed speed is 1800 r.p.m. At 1000 r.p.m. the b.m.e.p. is 108 lb. per sq. in., while the maximum torque of 300 lb.-ft. is developed at 800 r.p.m.

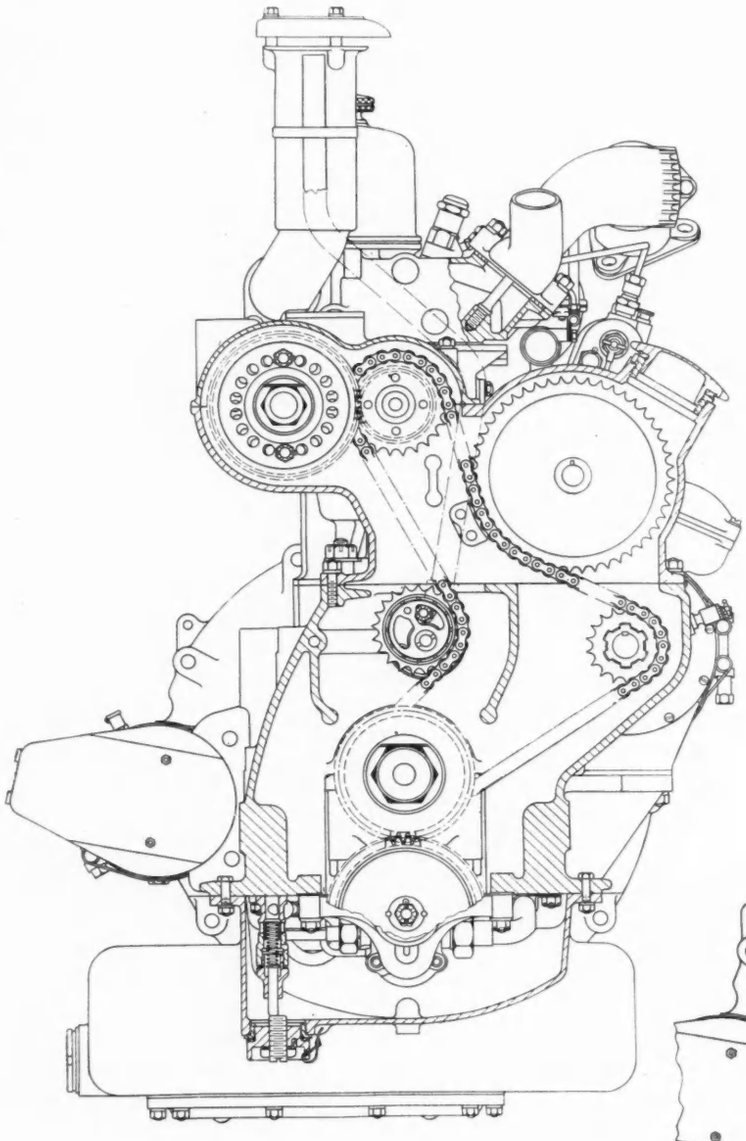
A minimum fuel consumption of 0.36 lb. per hp.-hr. is claimed, the compression ratio being 16 to 1.

Valves are operated by flat-faced cylindrical cam followers of chilled cast iron and short pushrods from the camshaft located in an oil-tight tunnel near the top of the cylinder block. Inlet valves are masked to induce a swirl in the entering air which, as the piston reaches the top of the compression stroke, is compressed into a cavity in its crown. The controlled turbulence thus produced is said to result in high combustion efficiency, smoke-free exhaust, and 10 per cent reduction in fuel consumption as compared with the air-cell type of engine of the same bore and stroke.



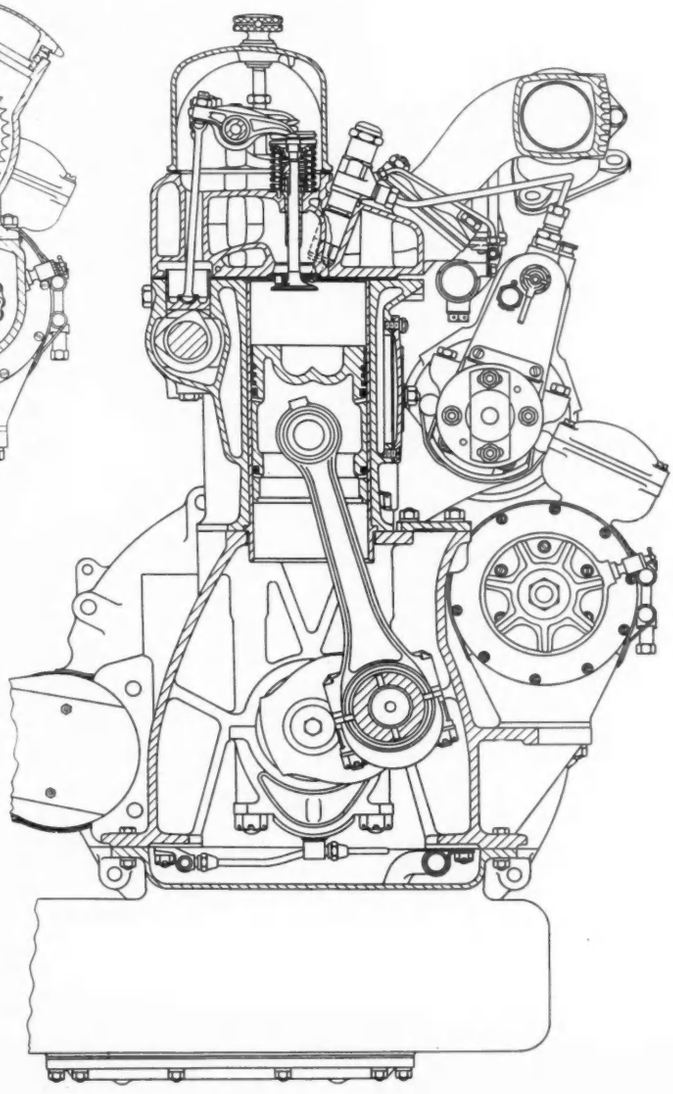
LONDON-BUS TYPE DIESEL ENGINE

Transverse Sections

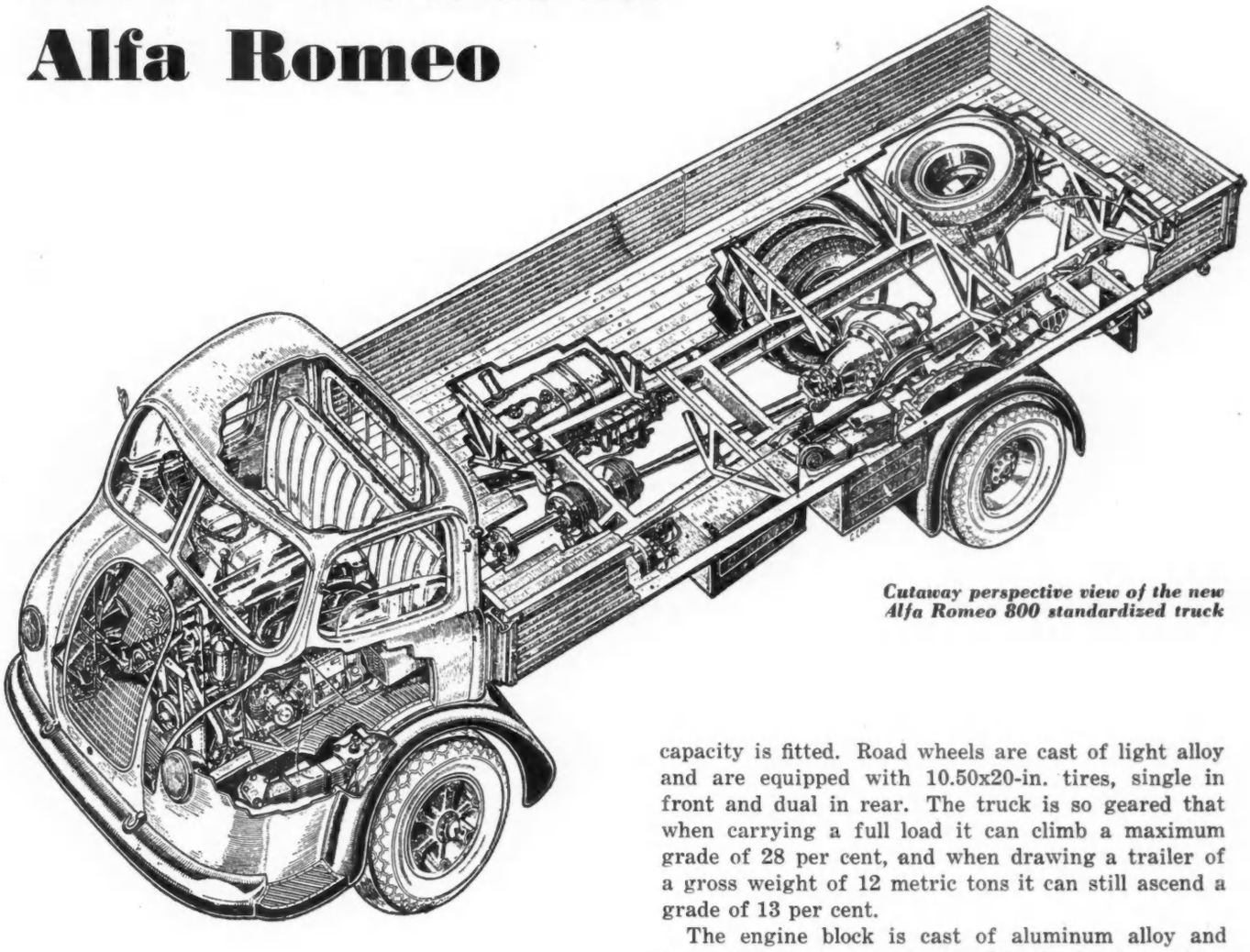


There are two cast-iron cylinder heads, each covering three cylinders. Dry cylinder liners are inserted from the bottom of the bores, where they are located by a circumferential flange clamped between the cylinder block and crankcase, these two being separate iron castings. Pistons are of aluminum alloy, with three compression and two oil control rings, one of these in the crown and the other in the skirt. Piston pins float. Connecting rods are 10¾ in. long between centers and have lead-bronze big-end liners. Journal bearings for the seven-bearing crankshaft have top halves of white-metal and bottom halves of lead bronze. Crankpins are 2 11/16 in. in diameter and their length between shoulders is 2 in. Main bearings are of 2 11/32 in. in diameter and the total bearing area of the main journals is approximately 42 sq. in.

The water pump is driven in tandem with the 24-volt generator. Forced lubrication is effected by a gear-type pump. Injection is by C.A.V.-Bosch equipment with a minimum and maximum speed governor. On truck chassis, for vacuum servo brake operation, an exhauster is fitted, driven in tandem with the fuel pump; it maintains a vacuum of 22-24 in. of mercury in a tank from which the brakes are operated directly. On the new London bus, compressed air is used for braking and gear-shifting. The dry weight of the engine complete with flywheel, is 1374 lb.



Diesel Powered Alfa Romeo



Cutaway perspective view of the new Alfa Romeo 800 standardized truck

A NEW heavy truck has been announced by the Alfa Romeo firm of Milan, Italy. It has a gross-vehicle-weight rating of 12 metric tons (26,400 lb.) and corresponds to one of the two Italian standards for heavy trucks, of 6.5 and 12 metric tons g.v.w., respectively. The chassis alone weighs 8800 lb., the complete vehicle empty, 11,000 lb., and the net load which can be carried, therefore, is 15,400 lb., or seven metric tons. The truck, which is of the cab-over-engine type, is equipped with a six-cylinder Diesel engine of 531 cu. in. displacement (4.53 by 5.51 in.) developing 115 hp. at 2000 r.p.m. With full load it is said to have a speed of 32 m.p.h, and under these same conditions the fuel mileage is 7.85 per U. S. gallon. The truck has a wheelbase of 150 in., a front tread of 78 in. and a rear tread of 68.5 in. The transmission gives four speeds forward and one reverse, but an extra reducing gear permits of obtaining eight forward and two reverse speeds. Hydraulically-operated service brakes act on all four wheels and are applied by air pressure. There is a parking brake which acts on the transmission. A fuel tank of 40 gals. capacity is fitted. Road wheels are cast of light alloy and are equipped with 10.50x20-in. tires, single in front and dual in rear. The truck is so geared that when carrying a full load it can climb a maximum grade of 28 per cent, and when drawing a trailer of a gross weight of 12 metric tons it can still ascend a grade of 13 per cent.

The engine block is cast of aluminum alloy and has wet liners inserted in it. Cylinder heads are iron castings, each of which contains three heads. These head castings carry the valve-actuating mechanism, the valves being located in the heads. Multi-orifice injectors are located at the center of the cylinder heads, and are said to be quite accessible and readily demountable. Special attention was given to the design of the inlet passages, with a view to creating energetic turbulence in the combustion chambers and thus to promote rapid combustion. The specific consumption of the engine at full output is given as 0.41 lb. per hp-hr., and the average consumption in operation is said to be little greater. Pistons are cast of aluminum alloy and provided with four compression and two oil-scraper rings each.

The rugged crankshaft is supported in seven main bearings lined with copper-lead bearing alloy. A vibration damper is mounted at the forward end of the shaft. The fuel injection pump is of Bosch make.

Pressure lubrication is provided, the oil being put under pressure by a gear pump located in the oil sump. Oil is drawn into the pump through a strainer, and on its way to the distribution gallery it passes through a filter of the metal-edge type which is self-cleaning. The radiator is of sectional type, and any of its sec-

(*Turn to page* 48, *please*)

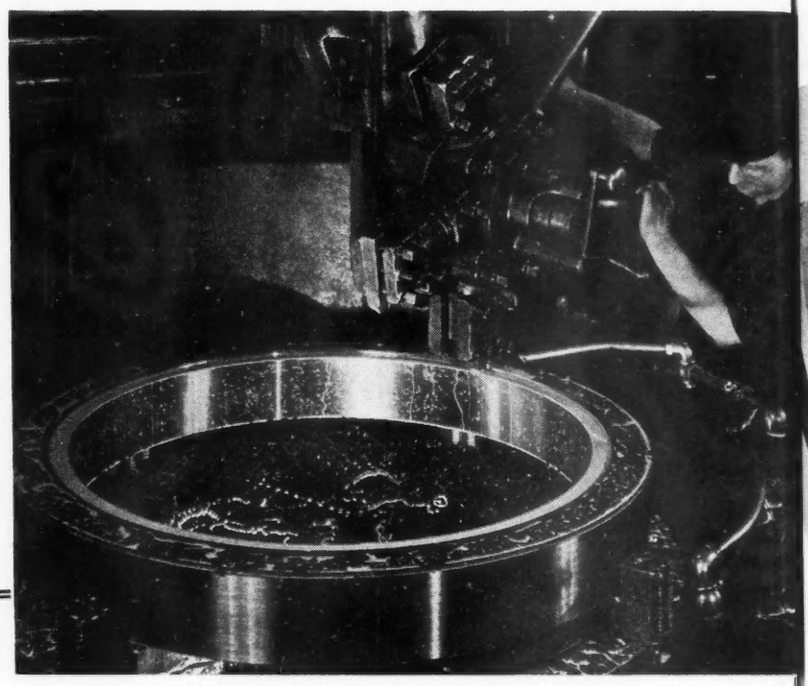
MEN and MACHINES . .

ONE of the largest users of tungsten-carbide tools for heavy turning in this country is the Nuttall Works of the Westinghouse Gearing Division. Under the pressure of demands for increased production speeds and greater accuracy, extensive experimental programs with these tools have been undertaken at this plant and considerable pioneering work has been accomplished in using them for a wide variety of steel turning. Tungsten-carbide tools lend themselves well to the cause of accuracy because their cutting edges wear less than tool steels and produce more uniform diameters without requiring resetting of production machinery. Case studies made at the Nuttall Works indicate, however, that from the production point of view the reduction in tooling costs may be a stronger reason than any other for using carbide tools.

A typical example is a ring gear, made of 40-50 carbon steel, heat-treated to a Brinell hardness of 350, from which 218 cu. in. of metal are removed in turning. Cutting speed during the studies was 180 ft. per min. at a feed of 0.018 in. per min. Carbide tools were used for turning both outside and inside diameters, as well as the face of the gear. Finish of the turned surfaces was smooth enough to be acceptable under the close tolerances established, and the bore was accurate enough to obviate the usual grinding to remove taper.

On a comparable basis the costs of turning this gear with tungsten-carbide and high-speed tools breaks down as shown in the accompanying table.

In these tabulations tool grinding costs for high-speed steels are included in the number of hours allowed per shaft, inasmuch as the lathe operator dresses his own tools. For car-

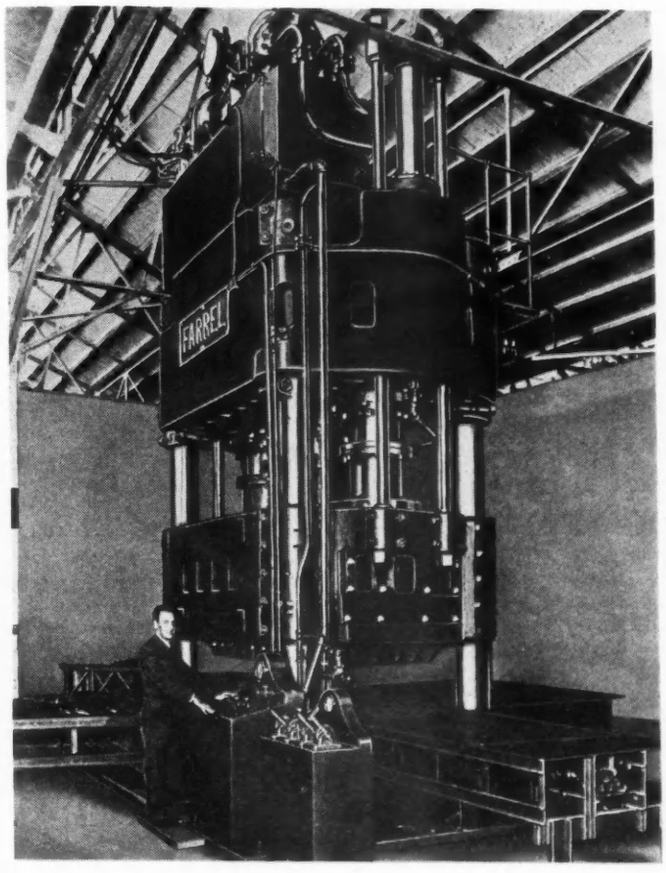


CARBIDE TOOLS SAVED 51% COSTS IN TURNING THIS RING GEAR

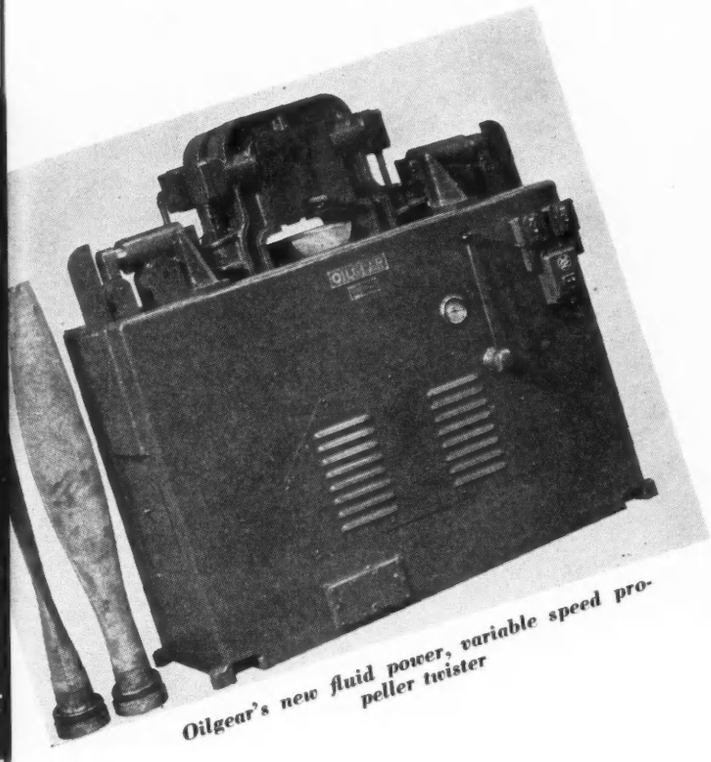
		High-Speed Steel	Carbide
Average number rings per tool grind		½	5
Cu. in. metal removed for each tool grind		109	1090
Number of grinds per tool		30	17
Number of rings per tool		15	85
Average cost per tool		$8.00	$24.00
Hours allowed per ring	Turning	4.90	3.53
	Grinding bore	2.70	.....
Tool cost per ring		1.06	.53
Tool grinding cost per ring		2.32	.10
Labor cost per ring		4.20	3.03
Total cost per ring		$7.58	$3.69

Similar savings for carbide tools were discovered in four other case studies:

Kind of Piece	Material	Turning Speed (f.p.m.)—Feed	Percentage Saving With Carbide
Shaft	Untreated forged steel, Brinell 190.	350—0.020	50%
	Heat-treated 40-50 carbon steel, Brinell 269-285.	280—0.020	47%
Shaft, 6¾ in. diameter, 51 in. long.	Untreated 30-40 carbon cast steel, Brinell 180.	240—0.018	12.5%
	Same gear, heat-treated before turning; Brinell 302.	180—0.018	41%



A 2200-ton hydraulic press built by Farrel-Birmingham for the blanking and forming of duralumin parts for all-metal airplanes

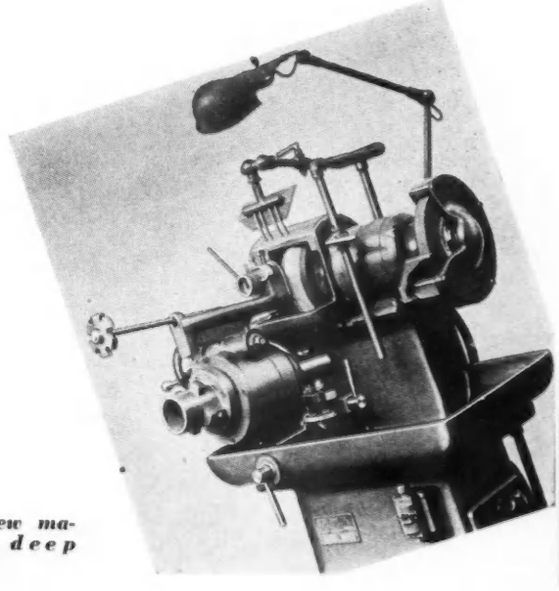


Oilgear's new fluid power, variable speed propeller twister

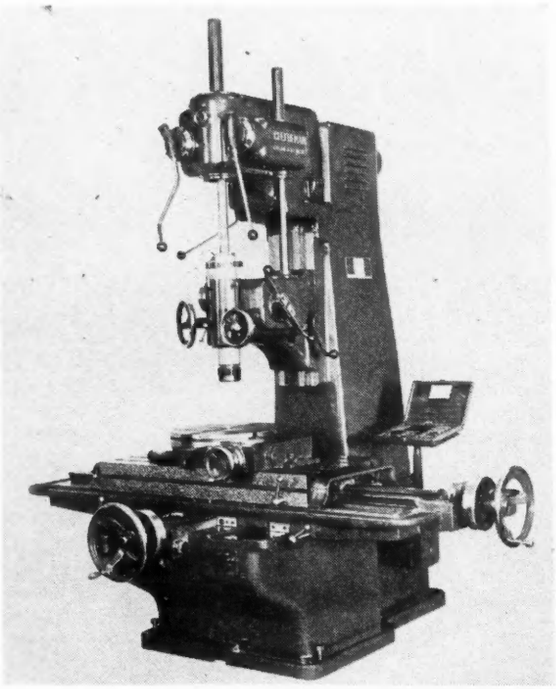
bide tools the grinding cost is allocated separately because tool dressing is performed in the tool room as an operation separate from production.

THE Oilgear Co., Milwaukee, Wis., is building a new style, fluid power, variable speed propeller twisting machine which is adapted for twisting 7 in. to 14 in. wide airplane blades to correct inaccuracies in pitch. The work possibilities of this machine are set forth by the manufacturer as follows: It permits blades to be forged very nearly to the finished size so that only a small amount of stock need be removed during the machining operations; it will twist an airplane propeller and maintain the axis of the twist upon the longitudinal centerline of the work piece; it may be adjusted to make twists between various lengths; and, it will operate in either direction and thereby either increase or decrease the pitch of a propeller blade.

Ease in operation and control with little fatigue to the operator is possible with the simple lever and pushbutton control. The airplane propeller blade is loaded from the back of the machine and threaded through the stationary clamp and twister clamp to the point to be twisted. The operator depresses the pushbutton control and the stationary clamp closes on the propeller blade under low pressure. If the propeller is in the proper position, the operator depresses the other pushbutton control and the twister clamp closes on the propeller under low pressure. If the propeller is to be twisted clockwise, the hand lever is moved to the right; if counter-clockwise, the hand lever is moved to the left.



Pratt & Whitney's new machine for sharpening deep hole drill tips



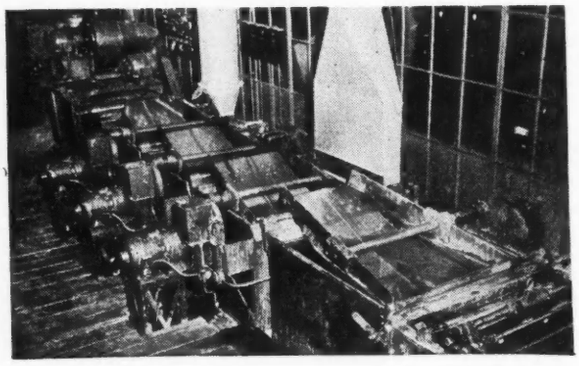
(Above) Cleereman jig borer with power rapid traverse to the table and carriage

2200 tons under a hydraulic pressure of 2500 lb. per sq. in. on one 38-in. ram and two 20-in. rams, the pump control is of such design that a wide range of hydraulic pressures may be obtained by a simple adjustment at the control panel, thereby varying the capacity of the press, as expressed in tonnage, in direct proportion to the hydraulic pressure. Two 10-in. diameter, single-acting push-back rams raise the moving platen to open position.

Dimensions of the clear space available between tie rods are 61 in. wide by 97 in. long. Overall dimensions of the bottom cross head and of the moving platen are 96 in. by 133 in. Both the moving platen and the bottom cross head are provided with T-slots running the width of the press and with machined surfaces for future addition of platen extensions to make the platen area 96 in. by 178 in.

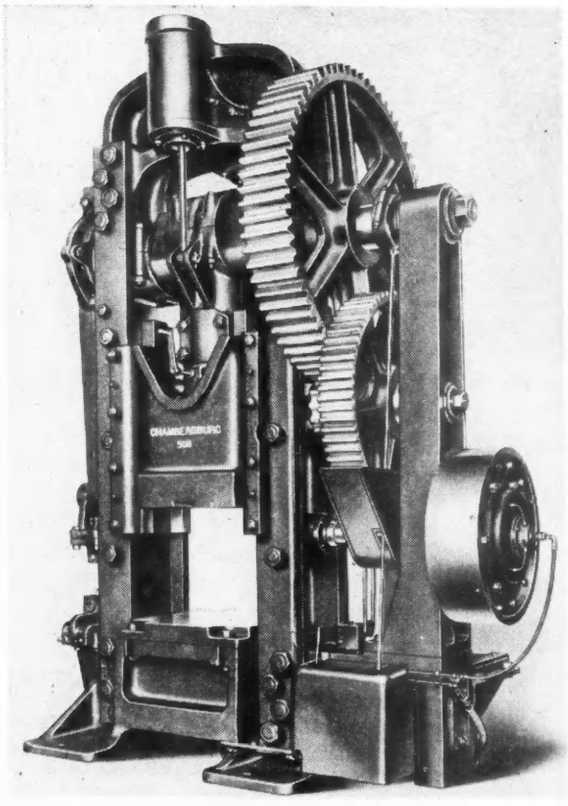
The presses are designed with a maximum opening of 60 in. and a maximum stroke of 36 in. Provision

(*Turn to page* 45, *please*)



(Left) Hopper type barrel plating machine built by Hanson-Van Winkle-Munning Co. and installed at Chrysler-Plymouth plant in Detroit

(Below) A 500-ton Chambersburg double-geared steel side press



Pressure on the stationary and twister clamp automatically increases in direct proportion to the increase in pressure required to twist the propeller. When the proper twist has been imparted, the pushbuttons are depressed to open the clamp, the hand lever is released and the twister support automatically returns to a pre-set horizontal position on the same axis as the stationary clamp support. The propeller is moved inward or outward to perform twisting operations on other sections of the blade. Center distance between the stationary and twisting clamp supports can be varied from 7 in. to 10 in. to vary the length of twist imparted to the propeller blade.

General specifications of this machine include the following: normal torque, 530,000 in.-lb.; twister clamp movement, 24 deg. (12 deg. either side); clamp gap for 7 in. to 14 in. wide propeller blades.

ONE of several new hydraulic presses built by Farrel-Birmingham Co., Inc., Ansonia, Conn., for the blanking and forming of duralumin parts for all-metal airplanes is illustrated herewith. Each press weighs upwards of 175 tons and stands nearly 26 ft. high. While the maximum capacity of these presses is

"Normal Production . . . Must Go Forward," Says Macauley

AMA Head Points Out That U. S. Armament Program Doesn't Much Exceed Year's Output By The Automotive Industry

"If this nation is to be able to bear the taxes that will be required to pay for the necessary defense program, normal production for sale to the domestic market must go forward at the largest possible rate," said Alvan Macauley, president of the Automobile Manufacturers Association, in addressing the annual meeting of that body, June 12, at Detroit.

"While we contribute what is needed to equip our defense establishment, we can do most to maintain the strength of this country by keeping up our normal business. Payrolls and employment must be created not only in factory cities but everywhere that cars and trucks are sold and used. It is essential that we have broad understanding of the importance of this task."

"Combining the two jobs—one immediate emergency service to external defense—the other domestic defense of national prosperity, is a challenge to private management."

In meeting this challenge, Macauley pointed out that the entire armament program now being formulated does not much exceed one normal year's output of the automotive industries.

Macauley cited the Eastman Report, which officially proclaims the fact that motor transport pays its own way, in proving that it is the one primary transportation system which is not subsidized in any degree.

Charles E. Wilson, chairman of the manufacturers committee, called attention to the industry's comparative freedom from labor difficulties in 1940 and termed it a "hopeful augury for the future." Wilson referred to the emergence of the UAW-CIO as the dominant labor organization in the industry and expressed hope that "the subsidence of union factionalism will result in more general observance of union agreements, an increased sense of responsibility and better membership discipline by the organization."

Attendance at the meeting was the best in a number of years, 90 representatives of 30 member companies being present.

Macauley, board chairman of the Packard Motor Car Co., was elected to his twelfth consecutive term as president of the AMA. Other officers reelected for one-year terms were Alfred P. Sloan, Jr., General Motors Corp., first vice-president; Paul G. Hoffman, Studebaker Corp., vice-president, passenger car division; Robert F. Black, White Motor Co., vice-president, commercial car division; Pyke Johnson, executive vice-president; Alfred Reeves, advisory vice-president, and Byron C. Foy, DeSoto Division, Chrysler Corp., secretary.

George W. Mason, Nash-Kelvinator Corp., was elected treasurer to fill the vacancy created by the death of Frederick J. Haynes. Four directors also were relected to three-year terms: Sloan, Foy, Charles W. Nash, Nash-Kelvinator Corp., and A. E. Barit, Hudson Motor Car Co.

Wright Opens New Engine Plant At Paterson, N. J.

On June 14 (Flag Day) the Wright Aeronautical Corp., Paterson, N. J., dedicated its new No. 2 plant at Paterson, adding about 540,000 sq. ft. of manufacturing floor space for the construction of radial aircraft engines. In an address during the dedication ceremonies, Guy W. Vaughan, president, said that recent instructions from Washington, D. C., indicated that the added capacity would have to be repeated immediately. This addition, with the plant recently acquired at Fairlawn. N. J. (No. 3 plant), gives Wright about 2,300,000 sq. ft. of floor space for engine building, assembling and testing.

The production layout in the No. 2 plant is referred to as "line" production of airplane engines although it differs from the high pressure system employed for motor car manufacture and assembly. Twelve double lines of machine tools in the plant are separated by wide aisles. These lines are intersected by three main cross aisles along which materials move. The aisles also serve as terminal points for collection and delivery of parts. Movement of parts from one operation to the next is by electric trucks which pick up skid tables on which the products are placed. There is no overhead monorail system or any part of production where floor conveyors are employed to move products. An exception is the spraying of paint on parts before final assembly where a monorail carries parts into and out of the paint spraying room.

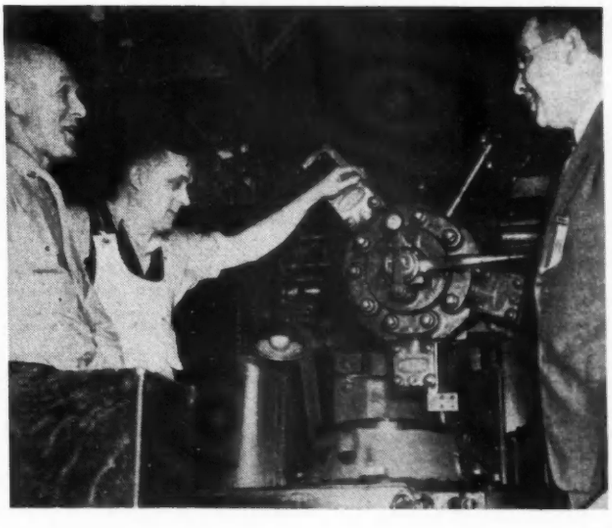
Manufacturing equipment includes more than 1250 new machine tools of which about 100 are special purpose machines. When completed, the No. 2 plant is expected to increase output to 1000 engines per month.

Aluminum Co. of America Reopens Casting Plant

The Aluminum Co. of America's casting plant in Buffalo, idle for eight years, is being reopened to manufacture magnesium castings for the aircraft industry. It is expected that the plant will be in operation by July 1. Employment will approximate 300.

Nearly $500,000 is being spent on the plant so it can turn out speedily metal parts of light weight for Curtiss-Wright and Pratt & Whitney.

Expansion



Myron Gordon, vice - president of the Wright Aeronautical Corp., Paterson, N. J. (right), and General George H. Brett, U. S. Army (left), shown on an inspection tour of Wright's new No. 2 plant dedicated on June 14. The new factory was built from foundation to roof in 57 working days

Acme

Monthly Motor Vehicle Production
(U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1940	1939	1940	1939	1940	1939
January	375,476	292,869	74,016	64,093	449,492	356,962
February	350,535	253,914	71,690	63,606	422,225	317,520
March	364,947	312,392	75,285	77,103	440,232	389,495
April	375,626	286,200	76,807	68,066	452,433	354,266
May	338,353	249,455	74,139	63,793	412,492	313,248
5 Months	1,804,937	1,394,830	371,937	336,661	2,176,874	1,731,491
June	.....	257,289	.....	66,964	.....	324,253
July	.....	155,850	.....	62,644	.....	218,494
August	.....	62,475	.....	40,868	.....	103,343
September	.....	165,119	.....	27,559	.....	192,678
October	.....	259,610	.....	65,078	.....	324,688
November	.....	295,134	.....	73,407	.....	368,541
December	.....	385,295	.....	83,825	.....	469,120
Total	.....	2,975,602	.....	757,006	.....	3,732,608

Passenger Car and Truck Production
(U. S. and Canada)

	May 1940	April 1940	May 1939	FIVE MONTHS 1940	FIVE MONTHS 1939	Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	315,441	351,814	222,909	1,682,199	1,245,240	+35.3
Foreign Market—U. S.	10,235	10,325	14,961	59,191	90,207	−34.4
Canada	12,677	13,487	11,585	63,547	59,383	+ 7.0
Total	338,353	375,626	249,455	1,804,937	1,394,830	+29.4
Trucks—U. S. and Canada						
Domestic Market—U. S.	56,340	61,452	47,126	285,448	249,332	+14.5
Foreign Market—U. S.	9,199	9,155	12,546	57,054	67,472	−15.3
Canada	8,600	6,200	4,121	29,435	19,861	+48.0
Total	74,139	76,807	63,793	371,937	336,665	+10.6
Total—Domestic Market—U. S.	371,781	413,266	270,035	1,967,647	1,494,572	+31.5
Total—Foreign Market—U. S.	19,434	19,480	27,507	116,245	157,679	−26.0
Total—Canada	21,277	19,687	15,706	92,982	79,244	+17.2
Total—Cars and Trucks—U. S. and Canada	412,492	452,433	313,248	2,176,874	1,731,495	+25.6

GM and CIO-UAW Sign New Contract

Two Innovations Include a Vacation Pay Allowance and Appointment of Impartial Umpire to Arbitrate Grievances

A vacation pay allowance and appointment of an impartial umpire to arbitrate grievances are two innovations in the new contract between General Motors and the UAW-CIO which was agreed upon June 16 at the conclusion of six weeks of negotiations. The contract was approved by the GM Council of the UAW-CIO June 18 and submitted to the membership of the 54 member locals for final ratification.

Under the new contract, each factory worker having one year's seniority as of July 1 will receive a vacation bonus of 40 hours' pay. This provision was substituted for one originally proposed by GM in which the vacation pay would have been equal to 2½ per cent of the worker's annual earnings. Cost of this vacation allowance is estimated at $7,000,000. Additional increases of approximately $5,000,000 will be applied to eliminate inequalities in pay between plants and within plants. The latter will be equivalent to an average increase of 1½ cents per hour for all employes covered by the agreement.

It was the wage issue that originally stalled the negotiations and prompted Dr. John R. Steelman, director of the Federal Labor Board's conciliation service, to enter the case and forestall any strike threat that might jeopardize the Government's new national defense program. Dr. Steelman was assisted by two federal mediators, James F. Dewey and James W. FitzPatrick.

An impartial umpire, employed jointly by the union and the corporation, will serve as final arbiter in certain types of grievances which cannot be settled by an appeal board of two corporation and two union members. The umpire, who will serve for a year's time, will be located in Detroit.

The new contract grants exclusive bargaining rights to the UAW-CIO in 54 plants in which it won elections, with the exception of craft units in a half dozen plants. It grants one shop committeeman for each 250 employes rather than each 300 workers. The handling of grievances also has been improved.

The union agrees not to cause or permit any sitdowns, stay-ins or slowdowns in any plant and to ban any picket lines until all steps in the bargaining procedure have been met. It also agrees not to strike until negotiations have continued for at least five days.

Reflecting the influence of last fall's

(*Turn to page 38, please*)

May Tire Shipments Top April By 14.2%

Automotive tire shipments during May showed a gain over April of 14.2 per cent due to large replacement shipments which more than offset the seasonal decrease in sales to automobile manufacturers according to statistics released by The Rubber Manufacturers Association, Inc. Total unit shipments during May amounted to 5,720,249.

Replacement sales totaled 3,635,652 units — the heaviest May replacement since 1934 when 3,675,326 units were shipped. May, 1940, replacements were 28.8 per cent over April and 9 per cent above May a year ago. Shipments for original equipment purposes declined to 1,998,735 units from the April shipments of 2,095,220 units. However, they were 46.3 per cent above May, 1939,

Mosquito

Rear view of the U. S. Navy's high-speed torpedo motor boat PT-9. Boats of this type are capable of a full-load speed of 50 m.p.h. Equipment includes four torpedoes, smoke screen apparatus and four machine guns

Acme

when 1,366,108 units were shipped. Export shipments for May were 85,862 units which compare with 91,249 units for April and 97,206 units for May, 1939.

Production during May amounted to 5,415,314 units—a gain of 6.1 per cent over April and 21.1 per cent over May, 1939. Stocks of automotive casings in the hands of manufacturers May 31 were 10,576,217 units, a decrease of 2.8 per cent under April 30 stocks, but 10.9 per cent above stocks on hand May 31, 1939.

Production of Hupp Skylarks Underway

The first Hupp Skylark models have come off the line and been shipped to dealers, J. Walter Drake, president of the Hupp Motor Car Corp., has announced. He also officially disclosed for the first time that a manufacturing contract has been entered into between the Hupp Motor Car Corp. and the Graham-Paige Motors Corp., under the terms of which the Hupp Skylark is being assembled in the Graham plant.

Hupp Skylark sales will be under the direction of W. A. McDonald, vice-president and director of sales of Hupp for several years past, who first joined the Hupp organization in 1914. Norman deVaux continues as general manager. All Hupp officials and department heads will continue to be located in their present offices at the Hupp plant.

Acme

Army Earthworms

These earth drill units were completed recently for the U. S. Army as part of the National Defense Program. The drills, mounted on heavy trucks, can drill holes up to 42 in. in diameter and as deep as 50 ft. They may be used to prepare tank traps, lay land mines and for other work of a mechanized army

Ourselves & Government

A Check List of Federal Action Corrected to June 25

FEDERAL TRADE COMMISSION

VS GENERAL MOTORS — Charge that dealers are required to handle GM parts exclusively. Commission attorney has filed exceptions to trial examiner's report. Respondent's brief due July 2, unless extension of time is granted.

F.O.B. PRICE CASE — Status unchanged (See AI, June 15, page 586).

RESISTANCE WELDER INDUSTRY—The Federal Trade Commission has set July 12 as the date for hearings on proposed trade practice rules for the resistance welder manufacturing industry. The Commission estimates the sales volume of resistance machines, their parts and equipment at approximately $6,000,000 annually. The machines are used to weld metal parts by means of resistance effected through the application of high-powered electric current. This type of welding, the Commission said, is extensively employed in the manufacture of automobiles and railroad cars in steel mills and in the fabrication of metal products generally. The conference on the trade practice rules was held in Chicago on April 30.

NATIONAL LABOR RELATIONS BOARD

Second supplemental decision (June 24) in General Motors nation-wide elections certified one AFL and one CIO union, ordered contested ballots opened in a third, and directed supplemental hearing to clarify the definition of the bargaining unit as to a fourth. CIO's UAW certified in engineering shops of Chevrolet Division, Hamtramck, Mich.; AFL's UAW certified for production and maintenance and mechanical employees at Kansas City Chevrolet Division. Ordered opening of three ballots cast in election among pattern makers at Saginaw (Mich.), Malleable Division. Election showed six votes for AFL, nine for CIO, one for neither and three challenged votes. Ordered supplemental hearing to clarify definition of bargaining unit established in all-party stipulation which provided for election among employees in oil sinking operations at forge, spring and bumper plant of Chevrolet Division, Detroit.

Four-Month Automotive Exports and Imports

	APRIL 1940		APRIL 1939		FOUR MONTHS ENDED APRIL 1940		FOUR MONTHS ENDED APRIL 1939	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 19,493,140		$ 24,921,194		$ 95,086,292		$ 100,116,220
PASSENGER CARS								
Passenger cars and chassis	8,041	5,245,130	16,119	10,036,050	41,803	25,839,386	65,008	40,017,711
Low price range $850 inclusive	7,065	4,232,687	14,568	8,380,706	36,812	20,723,822	57,789	32,343,744
Medium price range over $850 to $1200	846	811,387	1,307	1,254,065	4,351	4,121,259	6,183	5,920,773
$1200 to $2000	118	172,120	208	301,743	585	849,780	854	1,281,898
Over $2000	12	28,936	36	99,536	55	144,525	182	471,296
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	7,591	5,488,765	10,845	6,967,365	42,617	34,150,712	42,839	26,681,577
Under one ton	966	393,126	2,005	846,915	6,195	2,795,100	6,660	2,830,715
One and up to 1½ tons	5,394	3,038,207	6,446	3,679,278	25,914	14,379,241	29,057	15,727,463
Over 1½ tons to 2½ tons	742	812,340	1,959	1,658,908	7,385	9,889,469	5,045	4,341,214
Over 2½ tons	485	1,241,326	382	717,334	3,022	6,938,244	1,731	3,485,415
Bus chassis	4	3,768	53	64,930	101	148,658	346	296,770
PARTS, ETC.								
Parts except engines and tires		3,615,334		3,217,083		16,224,788		15,297,591
Automobile unit assemblies		3,530,552		3,451,870		14,417,940		12,694,588
Automobile parts for replacement (n.e.s.)		392,261		378,891		1,576,981		1,250,663
Other automobile accessories (n.e.s.)		311,832		624,116		1,388,547		2,059,381
Automobile service appliances	652	12,862,198	1,802	4,518,952	2,935	57,558,403	6,635	17,178,750
Airplanes, seaplanes and other aircraft	233	21,795,643	109	7,456,519	795	88,209,488	427	27,861,714
Parts of airplanes, except engines and tires								
INTERNAL COMBUSTION ENGINES								
Stationary and Portable								
Diesel and semi-Diesel	94	386,391	36	105,278	315	910,800	135	413,733
Other stationary and portable								
Not over 10 hp.	1,137	67,037	839	59,950	5,349	312,477	4,322	247,952
Over 10 hp.	217	305,647	214	117,875	870	1,102,685	497	365,543
Engines for:								
Motor trucks and buses	1,803	211,673	1,971	246,756	8,446	910,058	9,808	1,158,519
Passenger cars	2,612	258,566	1,615	146,646	8,681	781,612	10,823	1,030,747
Aircraft	358	2,980,568	155	1,043,723	1,297	11,172,726	416	2,782,957
Accessories and parts (carburetors)		344,783		238,585		1,426,107		848,608
IMPORTS								
Automobiles (dutiable)	62	71,328	36	26,293	200	219,478		122,398

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

Accelerated expansion of general business activity has continued. The seasonally adjusted index of The New York *Times* for the week ended June 8 rose to 98.8 per cent of the estimated normal, as compared with 96.5 a fortnight earlier and 89.8 a year ago. The unadjusted index of *The Journal of Commerce* advanced to 99.5 per cent of the 1927-29 average, as against 97.8 two weeks before.

The Federal Reserve adjusted index of industrial production in May rose to 105 per cent of the 1923-25 average from 102 for April, recent minimum, as compared with 128 last December and 92 a year ago.

Retail trade during week ended June 15 remained close to the preceding week's sharply increased levels —sales averaging from 7 to 10 per cent above those a year ago, according to Dun & Bradstreet estimates. Department store sales during the first week in June were 14 per cent above the comparable 1939 total, according to the Federal Reserve compilation, as against a year-to-year decline of nine per cent reported for the week before.

Production of electricity by the light and power industry during the week ended June 8 rose less than seasonally but reached the highest point in 12 weeks, 8.7 per cent above the corresponding output last year.

Railway freight movement in the same period established a new 1940 peak, with the loading of 702,571 cars, 15,081 more than the number a fortnight earlier and 11.5 per cent greater than that a year ago.

Bank debits to other than interbank accounts in leading cities during the 13-week period ended June 12 were seven per cent above the corresponding amount in 1939.

Crude oil production during the week ended June 15 declined by a negligible amount to an average of 3,816,200 barrels daily, exceeding by 195,900 barrels the required output as computed by the Bureau of Mines; the similar excess two weeks earlier was 148,050 barrels.

Average daily output of bituminous coal in the week ended June 8 was 1,345,000 tons, as compared with 1,407,000 tons for the week before and 1,051,000 tons a year ago.

Construction contracts awarded in May in 37 States were seven per cent above the comparable 1939 total, according to F. W. Dodge Corp. Residential contracts exceeds any other monthly amount since August, 1929.

Cotton-mill activity advanced more than seasonally in the week ended June 8. The New York *Times* adjusted index was 123.6, as compared with 123.2 a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended June 14 rose to 83.0 per cent of the 1926 average from 82.7 for the preceding week, the lowest level in eight months.

Excess reserves of the member banks of the Federal Reserve system rose $80,000,000 during the week ended June 12 to an estimated new peak of $6,610,000,000. Business loans of the reporting members increased $9,000,000 to a total of $4,377,000,000, or $546,000,000 more than the comparable amount last year.

Used Cars Scarce in Japan Although Exports Increase

Second-Hand Units Are Now Bringing From 50 To 200 Per Cent Above Their Original List Prices

In their enthusiasm for the "New Order" in East Asia, the Japanese are undergoing hardships and privations at home in order to show off with their industrial prowess in new protectorates and, possibly, to keep foreign competition out.

Thus, in striking contrast to the soaring export figures, the scarcity of cars in Japan has reached a point where one may speak of a national calamity. Second-hand vehicles fetch from 50 to 200 per cent above their original list prices. A 1937 Ford sedan sells for $1,500, the 1938 model for $2,800, with its original price about $600. Even the tiny Japanese *Datsun* recovers its cost price after 50,000 miles of wear.

The loan-hungry Mr. Aikawa, president of the Y100-million Manchuria Automobile Co. and other machinery enterprises in Manchukuo, has returned from a trip to Germany and Italy, where presumably he sounded business and government leaders on the possibility of credits "in kind." These credits are sorely needed to get the manufacture of automobiles and aircraft started. Several hundred million yen have been invested in automotive and machine-tool enterprises, for the most part as far back as 1938, but lack of credits and the breakdown of barter agreements in Europe have interfered with the practical execution of the production schemes.

The plan has been pulled out for consideration to remove Japanese motor and machinery plants to Manchukuo, not only lock, stock and barrel, but workers, technicians and subcontractors as well. Though to lay minds there seems to be no particular advantage, strategical or otherwise, in moving vital plants closer to the airbases of a potential enemy, into a semi-desert country, the competent quarters in Tokyo no doubt have good reasons for their haste in pushing the industrialization of Manchukuo.

Japan's official "Factory Statistics for 1938," just published, leave much to be desired in point of automotive industrial information. The less specific student, however, will find some illuminating data.

The value of production in the grouping, Machinery and Tools advanced from Y2,111 million in 1936 to Y3,823 million in 1938, representing respectively 14 per cent and 19.4 per cent of Japan's total industrial output. By comparison, the share of the textile industry declined from 29.8 per cent to 20.3 per cent with these two years. Since this trend has kept up, it is likely that Nippon's machinery industry has already outgrown her old textile industry.

The number of factories engaged in the production of automobiles, parts and accessories increased from 760 in 1936 to 1104 in 1938, with 25,237 and 38,016 workmen on the payrolls in 1936 and 1937 respectively, no figures being given for 1938. The publication of automotive production figures was suspended in 1937 and has not been resumed since. Aircraft production figures have not been published since 1932.

Figures recently released by the Department of Finance in Tokyo reveal a substantial increase in Jananese automotive exports, though these are probably confined to Japanese-controlled continental destinations. Exports of assembled automobiles averaged 500 cars for each of the first three months of this year, compared with 165 and 66 for the corresponding months in 1939

Inspection

Major Paul Kemmer, Material Division of Wright Field; Edsel Ford, president, Charles Sorensen, general manager, and P. E. Martin, production manager, Ford Motor Co. (left to right) discuss construction of a Curtiss P-40 pursuit plane at Dearborn, Mich.

Acme

and 1938. Tire exports for the first quarter reached a value of Y2 million, as compared with Y1 million in the corresponding period last year. Shipments of parts including chassis reached Y9.2 million in value, compared with Y3.9 million last year.

NSPA Automotive Sales Index Off One Point

The monthly automotive sales index prepared by the National Standard Parts Association indicates a decline in May of one point below April. This is, however, 20 per cent ahead of May, 1939. For the first five months of this year average monthly sales show an advance of 18 per cent over the first five months of 1939.

Replacement parts shipped to wholesalers in May advanced 2 per cent ahead of April. This is 20 per cent ahead of last May. The average monthly sales for the first five months of this year are 20 per cent ahead of the corresponding period of last year.

Shop equipment and tools shipped to wholesalers declined 8 per cent below April. However, May is still 14 per cent above May a year ago. Average monthly sales for the first five months of this year are 18 per cent ahead of the same period for 1939.

Original equipment shipped to vehicle manufacturers in May advanced 1 per cent over April. However, this is 49 per cent ahead of May, 1939. Average monthly sales for the year to date are 18 per cent ahead of the first five months of last year.

Export shipments for May declined 8 per cent below April. This is also 7 per cent below last May. However, average monthly sales for the first five months of this year are the same as for the first five months of last year.

From France

Louis Renault, French motor manufacturer and industrialist, and his son, Jean, photographed at the White House on June 11 when they visited President Roosevelt

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New Car Registrations and Estimated Dollar Volume by Retail Price Classes*†

	APRIL, 1940		FIRST FOUR MONTHS, 1940			
	Units	Dollar Volume	Units	Per Cent of Total	Dollar Volume	Per Cent of Total
Chevrolet, Ford and Plymouth	190,450	$145,600,000	626,303	54.69	$478,700,000	48.32
Others under $1,000	110,410	99,900,000	366,160	31.97	331,500,000	33.46
$1,001 to $1,500	44,809	50,700,000	144,277	12.60	163,400,000	16.50
$1,501 to $2,000	1,536	2,700,000	5,251	.46	9,100,000	.92
$2,001 to $3,000	870	2,100,000	3,136	.28	7,600,000	.77
$3,001 and over	12	100,000	54	.....	300,000	.03
Total	348,087	$301,100,000	1,145,181	100.00	$990,600,000	100.00
Miscellaneous	545	.....	663	.....	.....	.....
Total	348,632	.....	1,145,844	.....	.....	.....

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.
† Excluding Oklahoma for April.

Automotive Industries

Summary of Automotive Production Activity

BUSES Slight increases in output are reported. One company states that its production has continued good for the past six months and that "the future still looks as though it will hold'. A rather significant note is a report from the East that several unexpected inquiries indicate that preparedness employment already is beginning to tax urban bus facilities.

TRUCKS Several makers agree that production has been above normal for the past three weeks and that the outlook is for continued fairly high rate. A few manufacturers have considerable backlogs due to export cancellations and are offering domestic dealers attractive terms. A high official in one of the leading firms feels that in spite of the European situation, truck production schedules will be high for the remainder of the year and next year.

TRACTORS Both domestic and export sales have shown substantial increases and domestic sales have spurted as result of big demand for tractors on airport and highway jobs. Production continues at high level.

AUTOMOBILES Car and truck production in June estimated at 356,000 units. Volume for the first six months of 1940 now has passed the 2,500,000 mark. Output for July expected to remain reasonably high.

MARINE ENGINES Sales appear to be slowing up, except for larger units. Navy expansion programs will increase backlogs of some of the larger old-line makers.

AIRCRAFT ENGINES Backlogs continue to increase. Development work at high speed.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

ASTE Convention Set For Oct. 18

"Tooling with men and machines for National defense" will be the keynote of the semi-annual Convention of the American Society of Tool Engineers, scheduled for Cincinnati, Ohio, Oct. 17 to 19.

The sessions will include a symposium on the subject of "Should Industry Assume the Burden of Special Education." The subject is regarded as of immediate vital importance due to the shortage of trained tool engineers and designers in industry.

"Aeronautical Preparedness" will be the subject of the dinner meeting on the 18th, while technical programs will include a symposium on gear production methods.

18,000 Attend Machine Tool Show at Cleveland

Actual attendance at the Production & Machine Tool Show which opened in Cleveland on June 25 totaled well above early estimates to reach 18,000 with Cleveland registration being outnumbered by national and international registration. Many new machines were shown, some for the first time, by 30 national exhibitors whose displays occupied about 25,000 sq. ft. of floor space at the Cleveland public auditorium.

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Telemobile

A specially built motor coach with five sound - proof public telephone booths, called the "Telemobile," which made its debut at the Yankee Stadium, New York City, to supplement regular telephone service during the Louis-Godoy fight on June 20

MEN . . . . . .

Carl J. Halborg, formerly secretary, has been elected president of the Colonial Broach Co., Detroit, succeeding the late Otto Lundell. He has been associated with the company since its organization in 1918. **A. G. Lundell** and **Arvid Lundell** have been elected vice-presidents, the latter in charge of manufacturing. **David A. Nelson** has been named secretary-treasurer.

William A. Simonds, editor of the *Ford News* and director of Greenfield Village, was awarded the honorary degree of master of arts at the annual commencement exercises of Wayne University June 13 at Detroit.

John Haien, director of youth activities for the Chrysler Corp., has been appointed consultant to the government to coordinate the National Youth Administration program with national defense needs. Haien will divide his time between Washington and Detroit.

James S. Knowlson, president and board chairman of Stewart - Warner Corp., has been elected president of the Radio Manufacturers Association.

Walter J. Heinze has joined the sales force of the automobile division of The Crosley Corp. Mr. Heinze recently was southern sales manager for Nash Motors, a division of the Nash-Kelvinator Corp. Previously to that he was regional sales manager for the Hudson Motor Car Co., with headquarters in Washington, D. C.

R. N. Brown, formerly superintendent of production at the Packard Motor Car Co., has been appointed manager of the marine engine division, succeeding Wayne Eddy, resigned.

Clarence W. Avery, president and chairman of the board of the Murray Corp. of America, has been elected president of the Detroit Board of Commerce. Among the directors elected are **Joseph E. Fields**, vice-president of the Chrysler Corp.; **Hugh J. Ferry**, secretary - treasurer of the Packard Motor Car Co.; **Harvey C. Fruehauf**, president of the Fruehauf Trailer Co.; **William S. Knudsen**, president of the General Motors Corp.; and **A. M. Wibel**, director of purchases of the Ford Motor Co.

W. J. Buechling is now chief metallurgist at Copperweld Steel Co.'s new steel plant at Warren, Ohio. He was previously connected with Central Alloy Steel Corporation and Republic Steel Corp.

Paul Lindberg, until recently superintendent of rolling mills of the Steel

& Tube Division of the Timken Roller Bearing Co., Canton, Ohio, has been appointed superintendent of rolling mills of the steel division of the Copperweld Steel Co., Warren, Ohio.

L. P. Saunders, chief engineer of research engineering, Harrison Radiator division of General Motors Corp., Lockport, N. Y., has been elected a director of the Niagara County Chapter of the New York State Society of Professional Engineers.

R. F. Thalner has been appointed personnel director of the Buick Motor Division of General Motors, succeeding the late Elmer H. Kramer. Thalner has been with Buick since 1919, the last four years as assistant personnel director. He also will retain his supervisory post in the plant protection department.

J. B. Van Tassel, formerly with the Packard Motor Car Co., has joined the Chicago Automobile Trade Association as business management consultant. For 11 years he was with Packard, serving in the business management division of the factory sales department.

Alfred P. Sloan, Jr., chairman, has announced certain changes in the General Motors organization, to facilitate an aggressive execution of such part of the National Defense Program as may be assigned to General Motors. **J. D. Mooney,** vice-president in charge of the Overseas Group, New York, has been relieved of his responsibilities in this connection, and is transferred to Detroit as executive assistant to C. E. Wilson, acting president, in full charge of all negotiations involving defense equipment, and of such liaison activities as may be necessary in connection with the engineering and production of same. **Graeme K. Howard,** vice-president and general manager of Overseas Operations, New York, will assume general supervision of the Overseas Group, in place of Mr. Mooney. **Albert Bradley,** vice-president in charge of Finances, New York, is transferred to Detroit, and will assume additional duties as executive assistant to the acting president. These changes and assignments are of an emergency character and have necessarily no bearing on the corporation's normal staff responsibilities.

W. C. Anderson has been named sales manager of Electrical Testing Laboratories, New York, N. Y. It also has been announced that **Denis J. Lees** has been made assistant treasurer of ETL.

George E. Price, Jr., purchasing agent, Goodyear Tire & Rubber Co., was elected president of the National Association of Purchasing Agents at the Association's national convention in Cincinnati, Ohio, early in June.

John J. Borrup has been appointed production manager of Pratt & Whitney Aircraft. Promotions of **G. H. D. Miller** to factory manager and of **Daniel Jack** to assistant factory manager also have been announced.

Edward H. Moll has been named vice-president in charge of production for the American Bosch Corp., Springfield, Mass. **Foster N. Perry** has been named vice-president in charge of sales of this company.

J. S. Doyle has been appointed staff manager of the automotive department of Johns-Manville. Mr. Doyle takes the post made vacant by the recent death of B. E. Blaisdell.

Robert L. Clause has been elected to the newly created position of executive vice-president of the Pittsburgh Plate Glass Co. Directors of the company also have made a series of changes, effective July 1, that have resulted in promotions and re-arrangement of executive duties. **John A. Wilson,** general superintendent of plate glass factories, manager of glass manufacture; **D. G. Hill,** assistant to the vice-president, superintendent of plate glass factories; **R. B. Tucker,** manager of plate glass sales, director of glass sales; and, **B. J. Cassady,** secretary of the commercial department, general manager of warehouses.

New Contract

(*Continued from page 32*)

Chrysler strike, a clause provides that an authorized strike in one bargaining unit "which results in an interruption of the flow of material or services to operations in any other bargaining unit under this agreement will be considered an authorized strike in any such affected bargaining unit."

Sections calling for the discharge of aliens and employes guilty of sabotage as proposed by GM were excluded in the final contract, but the union was understood to have provided guarantees by separate letter that it opposed sabotage.

A leave of absence and retention of all seniority is granted to any employe called into active service with the armed forces of the U. S. Any relaxation of the U. S. law on the eight-hour day and 40-hour week, presumably for national defense purposes, is subject to negotiation.

Negotiating the final contract for GM were Charles E. Wilson, acting president; John Thomas Smith, vice-president and general counsel, and Floyd O. Tanner, vice-president in charge of labor relations. Representing the UAW-CIO were Philip Murray, CIO vice-president; Roy J. Thomas, president of the UAW-CIO, and Walter Reuther, director of the GM council. The UAW-CIO hailed the vacation pay and pay increases as a "CIO dividend."

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Monitor

Inspector W. I. Abbott of the Federal Communications Commission stands beside the specially equipped FCC monitoring car. The car contains a highly sensitive all-band radio receiver used to detect violations of the FCC's new order forbidding U. S. "Ham" operators from establishing contact with amateur broadcasters outside the United States and its possessions

Judge Leland W. Carr in Ingham County Circuit Court at Lansing, upheld the payment of unemployment benefits to 23,000 Chrysler workers in a decision handed down June 12. However, Judge Carr ruled out 12,000 additional workers in the Dodge Main, Truck and Forge plants who the appeal board of the Michigan Unemployment Compensation Commission had found eligible. His decision upheld the original ruling of Referee Charles Rubinoff, whose decision had been liberalized by the appeal board.

Judge Carr held that each of the nine Chrysler units is a separate establishment rather than one huge plant, as the Chrysler Corp. attorneys contended. He found that Chrysler workers in six plants not directly involved in the dispute were entitled to benefits but those in the three Dodge units were ineligible.

The unemployment compensation commission, which has been busy with the redetermination of claims in the case, estimated the benefits at approximately $1,500,000 under Judge Carr's decision. However, Judge Carr has not yet dissolved a restraining order preventing the payment of benefits until the appeal period of 30 days elapses. If the Chrysler Corp. or the employes disqualified from benefits under Judge Carr's decision appeal to the Michigan Supreme Court, it is likely that the case will not be decided before October,

when the supreme court reconvenes after the summer recess.

MEWA Board Retains Merger Committee

The Board of Directors of the Motor and Equipment Wholesalers Association, at its recent meeting in Chicago, took action which keeps the Association in readiness to work for the merger of the members of that Association with jobber members of the National Standard Parts Association if and when it should appear that progress toward a sound and practicable plan for the accomplishment of the objective can be made. The action was in form of decision to continue the Association's Merger Committee which now consists of Frank J. Stewart, M.E.W.A. president; H. J. Dinkmeyer, the Association's vice-president and G. E. Johnson, past president. A successor on the committee to the late "Ned" Vestal will soon be named.

In authorizing statement to the effect as above stated, the board re-emphasized the fact that, contrary to statements reported to have been made in some quarters, the sole reason for its interest, now and at any time, in accomplishing a merger is its desire to aid in bringing about as sound an association setup as is possible in order that the interests of automotive wholesalers may be most effectually represented.

Harry T. McDonald

Harry T. McDonald, research engineer, Caterpillar Tractor Co., died at his home in Peoria, Ill., on June 3. He succumbed to a heart attack.

CALENDAR

Conventions and Meetings

National Industrial Advertisers Association, Annual Meeting, Detroit, Sept. 18-20
American Society for Metals, Annual Meeting, Cleveland, Ohio....Oct. 21-25
American Welding Society, Annual Meeting, Cleveland .....Oct. 20-25
Aeronautical Chamber of Commerce of America, Inc., Annual Meeting, New York .....Dec. 5
National Association of Manufacturers, Annual Meeting, New York...Dec. 9-13
National Automobile Dealers Association, Convention, Pittsburgh, Pa. Jan. 20-23, 1941

Shows at Home and Abroad

National Automobile Show, Grand Central Palace, New York .....Oct. 12-19
Detroit Automobile Show .....Oct. 12-19
Pittsburgh Automobile Show.....Oct. 19-26
National Metal Congress & Exposition, Cleveland, O. .....Oct. 21-25
Chicago Automobile Show....Oct. 26-Nov. 3
Automotive Service Industries Show, Chicago .....Dec. 9-14
Machine & Tool Progress Exhibition, Detroit .....Mar. 24-29, 1941

Truck Production by Capacities
(U. S. and Canada)

	FOUR MONTHS			Per Cent of Total	
	1940	1939	Per Cent Change	1940	1939
1½ Tons and less	266,344	251,827	+ 5.9	89.39	92.29
2 to 3 Tons	18,399	12,108	+ 52.0	6.17	4.44
3½ Tons and over	4,312	4,000	+ 7.8	1.45	1.46
Special and buses	2,204	1,873	+ 17.5	.74	.69
Station Wagons	6,694	3,064	+118.5	2.25	1.12
Total	297,953	272,872	+ 9.2	100.00	100.00

Consumption of Crude Rubber Up 3% In May

According to statistics released by The Rubber Manufacturers Association, Inc., it is estimated that rubber manufacturers in the U. S. A. consumed 51,619 long tons of crude rubber during the month of May. This represents an increase of 3 per cent over the April consumption of 50,103 long tons, and is 13.5 per cent above May, 1939, when 45,484 (revised) long tons were consumed.

Gross imports for May as reported by the Department of Commerce were 51,431 long tons, representing a decrease of 27.2 per cent under the April figure of 70,699 long tons, and were 12 per cent over the 45,886 long tons imported in May, 1939.

Total domestic stocks are estimated by the association as of the end of May to be 161,446 long tons, a decrease of 0.6 per cent under the stocks on hand at the end of April, which were 162,459 (revised) long tons, and 14.1 per cent under the stocks of 187,980 (revised) long tons on hand at the end of May, 1939.

Crude rubber afloat to United States ports on May 31 is estimated to have been 109,364 long tons, which compares with 102,557 long tons reported afloat as of the end of April, and 54,046 long tons afloat May 31, 1939.

Reclaimed rubber consumption for May is estimated at 15,719 long tons, production at 17,552 long tons, and stocks on hand May 31, 1940, at 28,397 long tons.

Glenn L. Martin Sets Up A New Training School

Glenn L. Martin Co., Baltimore, Md., has announced formation of a new training school. Three classes of students have been entered in the new course—college graduates and non-graduates who have had little or no drafting experience; graduates of technical and vocational high schools with limited or no drafting experience, and college graduates who have been engaged for aerodynamic or stress analysis work and need training. Curricula include blueprint reading, drafting, engineering procedure, lettering, standard aeronautical practices and nomenclature and studies of handbooks and textbooks on Martin methods. Lectures deal with all phases of work the men will do when they are admitted as regular engineering staff members. Drafting and lettering practice is gained on detail work in the engineering department. Thus a considerable amount of engineering routine is cleared through the school.

This course will dovetail with the new shop training course instituted recently in the Martin engineering department. In order that new engineers understand more thoroughly the technological base on which their work must rest, they are sent into the factory for a time to learn the machine and craft operations. Transferred from one department to another, they do the actual work of building airplane parts and helping to assemble them. The students are on full pay while they attend school.

PUBLICATIONS

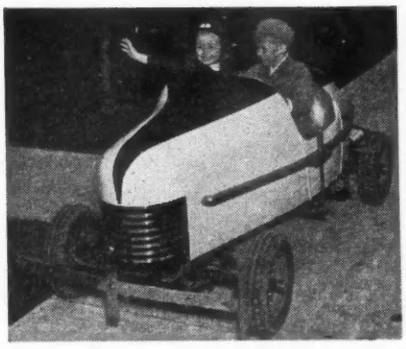
B. F. Goodrich Co., Akron, Ohio, has brought out a new catalog covering its mechanical goods. The volume is a threefold one, a condensed catalog, engineering data and guide to selection of various products.*

Circular No. 4, published by the **American Foundry Equipment Co.**, Mishawaka, Ind., describes a new continuous Wheelabrator Tum-Blast with a capacity of six tons per hour of grey iron or eight tons of forgings.*

ACP Rust-Proofer, product of the American Chemical Paint Co., Ambler, Pa., is the subject of a bulletin No. 7-8 issued by this company.*

The Van Keuren Co., Watertown, Mass., has announced a new **gear wire** circular, No. G 33. This folder contains simplified tables of measurements over wires for external and internal spur gears of 14½ deg., 20 deg. and 30 deg. pressure angle.*

Explanation of the construction and self-locking action of **Elastic Stop nuts,** manu-



Acme

Powered "Kiddie Car"

Karl Newhold, of Roseville, Mich., designed and built this automobile for children. The car is powered by a 2½ hp. engine. It will go 25 m.p.h. and is said to make 80 to 100 miles on a gallon of gasoline. The body is made of steel; wheelbase is 64-in.

factured by the Elastic Stop Nut Corp., Union, N. J., will be found in a new folder brought out by this company.*

Herman H. Sticht Co., Inc., New York City, has issued a folder, No. 700, entitled "Where Accurate Knowledge Counts". It describes the line of **portable speed measuring instruments** built by this firm.*

An **extruded tubing,** known as type XTE-30 is described fully in a bulletin entitled "Irv-O-Lite, A New Low-Cost Extruded Tubing," which has been issued by the Irvington Varnish & Insulator Co., Irvington, N. J.*

No. 36 in the series of pamphlets being issued by Farrel-Birmingham Co., Inc., Ansonia, Conn., is entitled **"Is Industrial Unemployment Actually Technological?"***

Thompson Products, Inc., Cleveland, Ohio, has published a yearbook of the first class to complete the four-year course of its industrial training program.*

Johnson Bronze Co., New Castle, Pa., has begun publication of data sheets dealing with "Ledaloyl", a self-lubricating sintered **bearing.** The three thus far issued deal with chemical and physical constituents, operating temperature, and method of installation.*

The mounting of self-sealed **ball bearings** on the eccentric of a small air compressor of the diaphragm type is the subject of bulletin VIII-15 issued by the advertising department, New Departure, Division of General Motors Corp., Bristol, Conn.*

The Transportation Division of the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, D. C., has completed a new 520-page handbook, **"Modern Export Packing".** This work contains a comprehensive discussion of the design and construction of the export packing methods employed for shipment of several hundred representative American manufactured products.

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES, Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Kettering Comments On 1000 Planes a Day Plan

Charles F. Kettering, vice-president of General Motors in charge of research, told a small group of technical editors on June 17 that reports of producing 1000 planes a day in this country might tend to create a false impression in people's minds "because the average American doesn't realize how long it takes to get ready to produce machines on a mass production basis." Mr. Kettering said that this was the one phase of American industry that was most misunderstood.

He warned that it was impossible to change the design of a machine once a mass production program had been started. American industry, he said, stood ready to produce large quantities of defense equipment, but it was up to the military authorities to decide first what type of equipment was needed. He added that it was not a question of producing things "we would like to have," but rather of deciding what things it would be easiest to produce in greatest quantity.

New Plant Occupied By Elastic Stop Nut Corp.

Elastic Stop Nut Corp. has moved its general offices from Elizabeth, N. J., to a new plant at Union, N. J., suburb of Newark. This plant will be used exclusively for the manufacture of Elastic Stop self-locking nuts.

Steel Buying for '41 Cars To Increase From Now On

"Blanket" Orders Placed By Automobile Makers Seeking To Avoid Delays Arising From Armament Demands

Steel sellers look for a steady increase in automobile manufacturers' purchases of 1941 model requirements from now on. A good many "blanket" orders are reported to have been placed already. These commitments amount in effect to the allocation of certain tonnages in certain mills, to be followed by specifications when the purchaser is in a position to issue these and to name the time of shipment.

Automobile manufacturers as well as parts makers are keenly aware of the possibility that, when they need steel for their 1941 assemblies urgently, mills may be under pressure to rush through armament material, and they are doing everything possible to minimize these potential difficulties. There is more stocking of those descriptions of finished steel, which permit of stocking, but especially in the case of full-finished body material relatively little can be done in the way of anticipating assembly schedules. In fact, the steel mills, themselves, apparently are finding it difficult to adjust their output of raw steel to the uncertainty of how much of a reserve it is wise to build up against later needs. The drop in the rate of ingot operations from 87.7 to 86.5 per cent of capacity in the week ended June 29, is ascribed to the need of downward revision of previous estimates of nearby consumption of finished steel. What little dislocation has been caused by the suspension of French armament orders, is expected to be more than made up for by impending releases of contracts for the National Defense Program, and the prevailing opinion in the steel market is that this week's minor curtailment in steel mill activity does not denote any trend in that direction. There are also a few isolated instances of slightly lower mill operations as the result of temporary shutdowns.

Spectacular ups and downs continued to feature the tin market. At the opening of the week ended June 29, spot Straits was offered at 53¾ cents, approximately $30 a ton lower than at the preceding week's close. The market yielded further ground on Tuesday, when a sharp break at Singapore and London sent the price for spot Straits down another $30 a ton to 52½ cents. France, which has recently been taking 1000 tons a month, is now out of the market. In fact, under present conditions the United States could now get double the tonnage of tin normally needed here without upsetting the market.—W. C. H.

Ford Production of Rolls-Royce Engines Called Off

Because of the Ford Motor Co.'s steadfast refusal to produce them in the United States for any foreign country, the National Defense Advisory Commission on June 25 announced it had called off negotiations to have the company manufacture 9000 Rolls-Royce airplane engines, 6000 for Great Britain and 3000 for this country.

William S. Knudsen, of the commission, who was negotiating with the Ford Co., said that cooperation in the production of engines will be sought elsewhere.

Knudsen said that, following a conference in Washington on June 11, Edsel Ford, president of the Ford company, telephoned that the arrangement for the production of the engines for the United States and Great Britain was satisfactory. Rolls-Royce engine drawings are said to have been delivered to the Ford company on June 19. On the same day Henry Ford is quoted as having said that he would make "any number of Rolls-Royce engines" for the United States but none for Britain.

Following Ford Tractors Down the Line

(*Continued from page* 11)

group is a unique two-way four-spindle milling machine tooled to rough and finish mill the power take-off pad and hinge bracket, milling of the rear face of the bearing diameter, and milling of the bevel gear clearance on the center housing. Operation of this machine is entirely hydraulic.

The fifth mechanic, typical of the new type unit head construction is a two-way double-end boring machine for rough boring both ends of rear axle housings. It consists of a welded steel base with a standard Model SH-75 self-contained hydraulic head at each end.

A similar machine is provided for chamfering both ends of the rear axle housing after boring.

Another interesting item of equipment is the massive Fox press, installed in the cylinder block department, used for pressing in the steel liners in the bores. This machine is illustrated in the pictorial section.

A battery of three Natco tapping machines also will be found in the tractor machine shop line. One of these is a three-way tapping machine built of one vertical and two horizontal reversing motor drive tapping units. Each unit is complete with a spindle box, the three boxes containing a total of 34 individual lead screw spindles complete with tap holders. Two of the spindles in the left hand head are provided with extensions and outboard supports.

Mounted on the fixture pedestal is a single stationary type fixture arranged to hold one cylinder block while the following operations are performed. Block is located by jacking up against the finished pan face and over pins in the master locating holes.

Operations

Vertical head—bottom of block—tap 19 holes
Right hand horizontal head—rear end of block—tap 5 holes
Left hand horizontal head—front end of block—tap 10 holes

The second machine on the cylinder block is a four-way tapper consisting of two reversing motor drive tapping units, including a vertical head, two horizontal heads, and an angular spindle extending from the vertical head. The three boxes contain a total of 30 individual lead screw spindles complete with tap holders.

All spindles in the vertical head, including the angular spindle, and the left hand horizontal head are driven by the vertical reversing motor drive unit. All spindles in the right hand head are driven by a second reversing motor drive unit. Right head also is provided with a hydraulic operated traverse to provide a rapid approach and return from the work.

Mounted on the bed is a stationary type fixture arranged to hold one cylinder block while the following operations are performed. Block is located on finished pan rail face and over disappearing pins in the two master locating holes.

Operations

Vertical head—top of block—tap 19 holes
Angular spindle—tap 1 hole
Right hand head—manifold side of block—tap 9 holes
Left hand head—water side of block—tap 1 hole

The third of the Natco machines is a lead screw tapper comprising three reversing motor drive tapping units, each complete with tap holders, with a total of 14 spindles for the entire unit. This machine is used for tapping the rear axle differential housing which is mounted in a fixture located in the center of the machine bed. The following operations are performed in one setting:

R. H. Head—Top face
Tap 14 holes
Ream 1 hole

L. H. Head—Bottom face
Tap 10 holes
Ream 1 hole
Rear Head — Rear end
Tap 8 holes

A battery of seven interesting pieces of equipment was supplied by Ingersoll. One of these is a huge two-spindle milling machine with a horizontal rotary table, used for rough- and finish-milling one side of the right hand and left hand front axle half. A similar machine is employed for the rough and finish-milling of the spring seat of the rear axle housing, right and left hand sections.

The big vertical boring mill shown in the pictorial section roughs and finish face-mills the bosses around two bores at the bell end of the transmission case.

ADVERTISING

Theodore F. MacManus has announced his re-entry into the national advertising field. Resuming advertising activities under the same name that he used for years, Theodore F. MacManus, Inc., Mr. MacManus states that he will handle a major automotive account in addition to the work he has been carrying on for the past two years in an endeavor to group Catholic diocesan newspapers into an affiliated chain of Sunday papers with features similar to secular dailies. Mr. McManus will set up two organizations, with Frank J. Mullen, national salesman for the *Saturday Evening Post*, as an associate, with separate personnel built around the two activities.

Ruthrauff & Ryan is working on an advertising program to promote the Ameripol or "Liberty rubber" tire, recently announced by B. F. Goodrich Co., Akron.

Willis Munro, formerly advertising manager of Hupp Motor Corp., has resigned as account executive for Grace & Bement, Detroit.

Leslie S. Gillette, vice-president of Hazard Advertising Corp. and formerly a member of the editorial staff of the Chilton publications, was elected president of the New York Sales Managers' Club.

Membership of ASTE In ASA Announced

Membership of the American Society of Tool Engineers in the American Standards Association has been announced by Ford R. Lamb, executive secretary of the former organization. E. W. Ernest, chairman, ASTE National Standards Committee, has been appointed to represent the Tool Engineers on the ASA Council. Mr. Ernest who is superintendent, Section "A," General Electric Co., Schenectady, also will represent the ASTE on the ASA mechanical standards committee. C. E. Ives, Ives Engineering Co., Chicago, will serve as alternate on the Council, and Carl J. Oxford, chief engineer, National Twist Drill & Tool Co., Detroit, as alternate on the mechanical standards committee.

Edward P. Hammond

Edward P. Hammond, president and general manager of the Gemmer Mfg. Co., Detroit, Mich., died on May 28.

40 YEARS AGO

At the recent German military maneuvers four-wheeled automobiles containing an officer and driver were used, for the most part, for the speedy conveyance of the elderly staff officers, and some of them ran at a speed as great as 20 or 40 miles an hour. War authorities consider that the day is not far distant when train horses will be replaced to a considerable extent by petroleum motors.—From *The Horseless Age*, July, 1900.

MEN and MACHINES

(*Continued from page* 30)

also is made to reduce the maximum opening to 38 in., maintaining the 36 in. stroke. Closing speed is variable from one to 130 in. per min., with a pressing speed of from one to 12 in. per min. The traverse, or return, speed is approximately 130 in. per min.

Conveyor tables are arranged on four sides of the press for loading and unloading to keep the press operating at maximum capacity. These tables are equipped with a movable platen on which dies are mounted and carried into and out of the press. Platens are controlled from a main control desk alongside the press control desk. The stroke of the conveyor cylinders is so designed that the platen registers uniformly on the press bolster. The construction of the conveyors is such that they can be readily removed in the event that large dies occupying the full length and width of the press are used.

JIG borers manufactured by Cleereman Machine Tool Co. and sold through its sales division, Bryant Machinery & Engineering Co., Chicago, are now available with power rapid traverse to the table and carriage. This consists essentially of a built-in motor which drives the screw through worm gearing, a small reversing drum switch used in conjunction with a magnetic reversing controller to control the motor and limit switches to prevent overtravel. Power rapid traverse is available for either the longitudinal travel only or for both the longitudinal and transverse.

A two jaw positive clutch is employed for engaging either the hand traverse handwheels or the power rapid traverse worm gear. When the power rapid traverse is engaged, the hand traverse handwheel is disengaged and does not rotate. The fine feed handwheel is located on the end of the vertical motor shaft and utilizes the same worm and gear as the power rapid traverse. With this construction it is possible to engage the power rapid traverse clutch, leave it engaged and never use the hand traverse handwheel. Approximate settings are made with the power rapid traverse by merely flipping a switch. The final precise adjustment of the table is then made by means of the fine feed handwheel.

Limit switches in the pilot circuit of the magnetic controllers are provided at each end of the travel to prevent accidental overtravel. On machines fitted with end measuring rod equipment, one limit switch is built into the dial indicator housing to stop the rapid traverse motor just before the measuring rods contact the anvil of the dial indicator. The final fine adjustment is then made by means of a few turns of the fine feed handwheel.

PRATT & WHITNEY, Division Niles-Bement-Pond Co., West Hartford, Conn., has developed a new machine for sharpening deep hole drill tips. The machine is designed to sharpen drills with from 3/16 in. to ⅝ in. diameters inclusive. Roughing, finishing and general purpose grinding wheels are driven directly by a 1/3 hp. motor. The coolant system consists of a pump and 1/6 hp. motor mounted at the rear of the pedestal, suitable piping for all wheels, and a coolant reservoir inside the pedestal with provisions for removing sediment and draining. Coolant and spindle motors are connected to the same starter, and therefore operate simultaneously.

The drill to be sharpened is inserted in a drill bushing and cam mounted on the rocker. Four removable bushings and cams of different sizes and pitches are furnished with the machine. The surface on the face of the cam contacts a cam abutment and produce the correct helix and dwell positions.

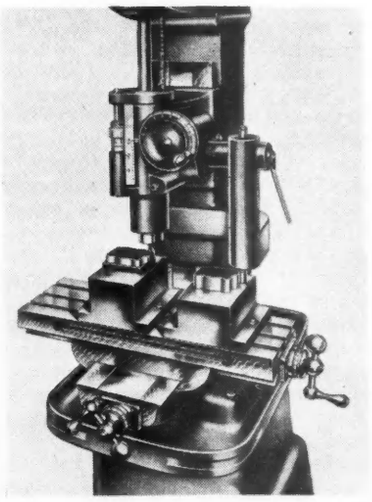
An adjusting nut at the front of the rocker feeds the entire rocker unit on a threaded shaft toward or away from the grinding wheel. This shaft is fastened to the elevating shaft, which provides verticals adjustment through

a nut to obtain the desired relief at the cutting edge.

The rocker housing contains a worm shaft which, when rotated, swings the entire unit around a gear on the threaded rocker shaft. This furnishes the means for moving from the roughing to the finishing wheel, and also acts as a sidewise feed while sharpening.

For dressing the roughing and finishing wheels, the diamond with its bushing is mounted on the rocker. The entire rocker unit can be swiveled about the elevating shaft and bound in the desired position, a graduated dial indicating the amount of the swivel. By this means the wheels can be dressed to the proper angle. Provisions for step grinding are available, although it may require a slightly harder grinding wheel. Stepping the drill splits the chips and facilitates their passage through the chip groove in the shank. It also tends to make smoother holes and longer life between sharpenings.

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa., is offering a line of double geared steel side trimming presses in capacities up to 1000 tons. Sizes of 150 tons and over are equipped with an improved type pneumatically operated clutch.



Profiling attachment developed by Machinery Mfg. Co. for use on Vernon combination vertical mill and jig borer

All presses are of the patented forged steel side frame construction, and the standard Chambersburg features of oversize crank, the use of outboard bearings on all shafts, reinforced Pitman, extra large Pitman pin, and gears cut from solid steel are included.

AN installation at the Chrysler-Plymouth plant in Detroit of a new hopper type barrel plating machine built by the Hanson-Van Winkle-Munning Co., Matawan, N. J., has been in operation for a sufficient length of time to yield production figures which indicate the efficiency of the equipment. A variety of small parts, which were very difficult to clean by the ordinary dipping basket method, are run through a cleaning cycle, from hopper to hopper, and finally plated.

Each hopper requires approximately 55 sec. to make a cycle. That is, from the time the button is first pushed, it takes 55 sec. for the hopper to rise and return back to its seating position. From the time the first button is pushed until all the work is transferred to the next hopper, 20 sec. elapse. From the time the button on the first hopper is pushed until the fourth hopper comes back to seating position, 3 2/3 min. elapse. Production through these hoppers, providing the hoppers are loaded continuously, is one hopper load into the dryer every 110 sec. The plating cylinders take from 75 to 200 lb. at a time, depending upon the size and shape of the parts.

At the present time, seven men are required in this plating line, employed as follows: one man shoveling stock into cleaning cylinders, one man operating the hoist on the cleaning unit, one man taking care of loading the plating cylinders from the skid table, two men on the plating unit, one man on the hoppers, one man on the dryer.

It is estimated that with a slight change this force can be reduced to five, which will equal the present production of from 3000 to 4000 lb. of work per hour.

Machine Tool Capacity Continues Above 90%

The National Machine Tool Builders' Association reports its capacity index of the machine tool industry's operating rate during May at 92.5 per cent compared to 93.4 per cent for April, 1940. The capacity index, holding above 90 per cent for the seventh consecutive month, reveals only partially the operating activity of the industry. According to the Association, the capacity itself, measured in terms of payroll hours, has increased month by month since last September and stands now 25 per cent above the capacity figure taken as the 100 per cent measure in September, 1939.

FOR duplication of work in metal, plastics, patterns and dies, a profiling attachment has been developed by Machinery Mfg. Co., Los Angeles, for use on the Vernon combination vertical mill and jig borer. The sliding head of the tool is so constructed that this attachment can be easily and quickly engaged and disengaged. The attachment has been developed especially for small lot machining or irregularly shaped forgings, but it is applicable also to contour milling from wood, plaster or plastic models.

OTHER new developments are, briefly, as follows:

Van Keuren Co., Watertown, Mass.—A set of measuring wires, No. 26IN, suitable for checking internal spur gears.

New Method Steel Stamp Co., Detroit.—Marking device, designed for marking of such annular parts as gears, bushings, and bearings in quantity production, eliminates usual setscrews, etc., required to hold removable type in place.

E. C. Atkins & Co., Indianapolis, Ind.—Power metal cutting saws to be identified as a group under the general term "Atkins Curled Chip System of Metal Cutting." A new tooth design, formed with an inward curved cutting edge, produces a curled, clock-spring-like chip in cutting.

South Bend Lathe Works, South Bend, Ind.—Ten-inch swing, one-inch collet capacity series "S" tool room bench lathe made in 3, 3½, 4, and 4½ ft. bed lengths, providing center distances of 16⅜ in., 21⅜in., 27⅜ in. and 34⅜ in. respectively.

Mercury Clutch Corp., Massilon, Ohio.—New Mercury clutch permits driving motor to gain speed before assuming load. Utilizing mercury to displace friction segments by centrifugal force, the clutch gradually picks up the load at full speed. At present, 4 and 4½ in. diameter sizes are standard and will transmit loads up to 5 hp. Other sizes available on specification.

J-B-T Instruments, Inc., New Haven, Conn.—New type of portable potentiometer for measurement of temperatures by thermocouples. Applications in industrial, laboratory, electrical, and moving vehicle temperature reading. Also designed for testing permanently installed temperature measuring and controlling equipment. Known as Model 70-PO.—H. E. B., Jr.

Publications Available on Machine Tools

"Eminent Engineering", a folder issued by Continental Machines, Inc., Minneapolis, Minn., describes features of the **Doall contour machines.***

Reed micrometers are described in a leaflet brought out by George Scherr Co., Inc., New York, N. Y. The Scherr company has been appointed national distributor for this line which is manufactured by the Reed Small Tool Works, Worcester, Mass.*

The entire line of **pantograph engraving machines,** built by the George Gorton Machine Co., Racine, Wis., is described in a new catalog.*

Various types of **high-speed and carbon**

steel drills, manufactured by Whitman & Barnes, Detroit, are described in a new circular.*

"Airco Electric Welding Products", a 32-page illustrated booklet issued by Air Reduction, New York, N. Y., describes the complete line of **Airco electrodes and Wilson electric welding machines.***

The Landis Tool Co., Waynesboro, Pa., has prepared an elaborate brochure which emphasizes the application of its **grinders** to the aircraft industry.*

The **Beryllium Corp. of Pennsylvania** has brought out the first of a series of technical bulletins to be published under the title "Engineering Data Sheet". Berylco No. 25 is the subject of Vol. 1, No. 1.*

A discussion of important preliminaries to **die casting die designs** is included in general sales bulletin No. 100 prepared by the Madison-Kipp Corp., Madison, Wis.*

Unusual jobs done on Doall **contour shaping machines,** are sketched and described in a scrapbook published by Continental Machines, Inc., Minneapolis, Minn.*

Detailed information on **benders and tube fabricating equipment,** built by the Parker Appliance Co., Cleveland, Ohio, is included in this company's bulletin No. 40 E.*

A 96-page catalog, recently completed by the Ahlberg Bearing Co., Chicago, contains dimensional data on all types of **ball bearings,** tapered roller bearings, straight roller bearings, thrust bearings and ball bearing pillow blocks. Two other sections in the catalog are devoted to mounted bearings and engineering data.*

Gisholt Machine Co., Madison, Wis., has brought out a catalog which illustrates and describes standard tools for its 1L, 2L and 3L **high production turret lathes.***

Ex-Cell-O Corp., Detroit, has issued a 12-page folder on the process of **precision thread grinding.***

Catalog No. 77, issued by the Eclipse Air Brush Co., Inc., Newark, N. J., describes this company's complete line of **spray equipment** for both manual and automatic operation.*

The Harnischfeger Corp., Milwaukee, Wis., has released the first issue of the **P&H Weld,** a publication to be issued regularly to those interested in welding. Its purpose, according to the company, is "to act as a central bureau for receiving and disseminating information on current welding practices".*

A new catalog on Steelweld **bending presses** has been issued by the Steelweld Machinery Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.*

* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Urge Development Of Alcohol-Fuel Program

In a network broadcast on June 22, Representative Rudolf G. Tenerowicz, Democrat of Washington, and Richard A. Staderman, president of the American Good Government Society, promoted a bill introduced by Dr. Tenerowicz to encourage the use of alcohol distilled from surplus crops as a component of gasoline for use in airplanes and automobiles.

They described what was called a broad program of self-sufficiency for the United States, including the alcohol-fuel plan as well as the making of artificial rubber from oil, which was said to be essential for an adequate national defense "safe from the whims or exigencies of other nations." The speakers pointed out that "alcohol and gasoline mixtures would be of great benefit to the United States rearming program."

Diesel Powered Alfa Romeo

(*Continued from page* 27)

tions can be replaced independently in case of injury. Radiator shutters are controlled by a thermostat. Ordinarily an electric starter of 6 hp. is installed, but this may be replaced by a hand-operated inertia starter which is said to be able to start the engine without the use of auxiliary apparatus at the lowest temperatures ordinarily encountered. Other standard equipment includes a large-capacity generator and an air compressor. The generator keeps two 12-volt batteries of the standardized 110-amp-hr. capacity charged. Both the generator and the starter are wound for 24 volts, while consuming devices are of the 12-volt type. The air compressor supplies air at 80-lb. pressure to a storage tank of about 2.5 cu. ft. capacity, this air being used for the air brakes on both tractor and trailer.